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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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PROFESSOR JAMES GEIKIE, LL.D., D.C.L., F.R.S., HON. EDITOR
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Teacher Associate Membership.—The Royal Scottish Geographical Society, at a Meeting held in the Society's Rooms on the 8th November 1906, resolved that, with the object of helping to promote the teaching of Geography in Schools, "Teacher Associates" (including Lady Teachers) be admitted to certain privileges of the Society at a reduced Subscription of Half-a-Guinea, payable *in advance* at the commencement of each Session.

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Yours truly
Robt Griffiths

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE ETHNOLOGY OF AUSTRIA-HUNGARY.

By Ralph Richardson.

(*With Map.*)

As the racial question has recently been raised in an acute form both in Austria and Hungary, it is well to consider the ethnology of these two countries, united as they are in one monarchy, that of Austria-Hungary. We shall be surprised to find what a mosaic of nationalities is comprised in the simple term "Austria-Hungary."

The extent and population of the Austro-Hungarian monarchy give it the rank and importance of a Great Power, and were its population united in one race the monarchy would be one of the strongest in the world. Torn asunder, however, as Austria-Hungary is by racial differences, the apparently great Empire seems likely to be brought to the verge of dissolution should any national catastrophe occur; and the future of the monarchy is regarded by the rest of Europe with anxiety, and its possible collapse with dread.

According to the last census, that of 1900, the population of Austria was 26,150,708, and consisted, on the basis of language, of the following races: Germans, 9,171,614; Czechs, Moravians, and Slovaks, 5,955,397; Poles, 4,252,483; Ruthenians, 3,381,570; Slovenes, 1,192,780; Italians and Ladinians, 727,102; Servians and Croats, 711,380; Roumanians, 230,963; Magyars, 9516; others, 517,903.

According to the same census, that of 1900, the population of Hungary was 19,254,559, and consisted, on the basis of language, of the following races: Magyars, 8,742,301; Roumanians, 2,799,479; Germans, 2,135,181; Slovaks, 2,019,641; Croats, 1,678,569; Servians, 1,052,180; Ruthenians, 429,447; others, 397,761.

In terms of the Berlin Treaty of 1878, Austria-Hungary likewise administers Bosnia and Herzegovina (population, census 1895, 1,568,092), and occupies Novi Bazar (population, census 1879, 168,000). Including these states (which have been exceedingly well administered) Austria-

Hungary has a total population of 47,139,359. This considerably exceeds the population of the United Kingdom of Great Britain and Ireland, which was in 1901 41,976,827, but the area of Austria-Hungary is more than double that of the United Kingdom.

There are, as will presently be shown, no fewer than eighteen different races resident in Austria-Hungary, and of these there are two *ruling* races—the Germans in Austria and the Magyars in Hungary. Both these ruling races, however, are dwarfed numerically by other races.

Thus, in Austria there are only 9,171,614 Germans out of a total population of 26,150,708, leaving the Germans in a numerical inferiority of 16,979,094. Similarly, in Hungary, there are only 8,742,301 Magyars out of a total population of 19,254,559, leaving the Magyars in a numerical inferiority of 10,512,258.

When, however, we regard the Austro-Hungarian monarchy as a whole, without dividing it into Austria and Hungary (an artificial and purely political division at the best), we find that it contains the following great families :—

1. *Slavs*, comprising Czechs, Moravians, Slovaks, Poles, Ruthenians, Slovenes, Servians, and Croats, and numbering altogether .	22,409,539
2. *Germans*, numbering . . .	11,306,795
3. *Magyars*, numbering . . .	8,751,817
4. *Roumanians*, numbering . . .	3,030,442
5. *Italians and Ladinians*, numbering . .	727,102
6. *Others* (including Jews and Gipsies) .	913,664
Total,	47,139,359

From this we perceive that Austria-Hungary is neither a German nor a Magyar state, but is really a Slavonic empire, the Slavs outnumbering the Germans by two to one, and the Magyars by between two and three to one. Whatever, therefore, the future of Austria-Hungary may be, unless due regard is paid to its "predominant partner," the Slav, racial injustice will be done, and political trouble will result.

It is interesting to compare these ethnological details for 1900, as established by an official census, with the estimate of the ethnology of the Austro-Hungarian Empire made by Dr. Adolf Schmidt, Lecturer in the Imperial High School of Vienna, in his *Handbuch der Geographie des Oestereichischen Kaiser-Staates*, published at Vienna, in 1850. Dr. Schmidt therein estimates and localises the various races as follows :—

Slavs—15 millions, found in all provinces except Lombardy and Venice (then Austrian possessions), but especially in Bohemia, Moravia, Galicia, Hungary, Illyria, and Dalmatia.

Germans—7 millions, found in all provinces, but especially in Tyrol and the Archduchy of Austria.

Magyars—5 millions, found in Hungary and Transylvania.

Italians—4½ millions, found especially in Lombardy and Venice, but also in Illyria and Dalmatia.

Wallachs—2 millions, found especially in Transylvania, but also in Hungary.

Jews—Three-quarters of a million, found in all provinces but Styria, and not many in Tyrol.

Gipsies—Over 50,000, found in Transylvania and Hungary.

Comparing Dr. Schmidt's estimate of 1850 with the census returns of 1900, we see that, during the interval of fifty years, the Slavs have increased by 7 millions, the Germans by 4 millions, the Magyars by 3 millions, and the Roumanians (Wallachs) by 1 million.

In some places it is found that the Slavs are pushing other races out. Thus, in *l'Abrégé du Bulletin de la Société Hongroise de Géographie*, published at Budapest in 1899 (p. 19), Dr. Rudolf Havass remarks:—"The Magyars form a small people, and it is for them of the utmost importance to know whether the Magyar nation, surrounded as it is by alien races, is on the upgrade or downgrade as regards population." From a comparison of the population statistics for ten years made by Dr. Josef v. Körösy, Dr. Havass reviews the state of the population in the Hungarian Oberland, and comes to the conclusion that, during the ten years up to and including the census of 1891, the Magyars had diminished to the extent of over 100,000 in the four counties (*comitaten*) of Pozsony, Nyitra, Bars, and Hont, their place being taken by Slav immigrants. Pozsony is the Magyar name for the town of Pressburg, the first Hungarian town on the Vienna-Budapest railway line, and the other three counties lie to the east of the county of Pozsony. The Slavs migrating there are probably Czechs and Slovaks pressing south towards the fertile plain of the Danube known as the "Little Alföld."

The geographical distribution of the various peoples comprising the Austro-Hungarian monarchy is not without interest physiographically. The monarchy is nearly encircled by mountains, the Alps on the west merging into the uplands of Bohemia, which form the north-west of the monarchy, its north-east being surrounded by the Carpathians. A southern extension of the Alps forms the coastline of the Adriatic, the south-western frontier of Austria-Hungary. With the exception of Silesia, Galicia, and Bukowina (which lie open principally to Russia), and a stretch of river above and below Belgrade, the Austro-Hungarian monarchy is well buttressed against external enemies.

Ethnically, however, mountain-barriers are not insurmountable, and in Austria-Hungary the various contending nationalities mingle as in a seething reservoir, the Germans from the west, the Czechs and Slovaks from the north-west, the Poles and Ruthenians from the north-east, the Roumanians from the south-east, the Italians from the south-west, the Croats, Servians, and Slovenes from the south, while the Magyars in the centre battle with all the converging streams. Austria-Hungary is the meeting-place of most of the great races of Europe, and it is of surpassing interest ethnically, for it is there that the eternal problem of the survival of the fittest is being daily fought out.

In the midst of this mountain-girt monarchy lies the country of the

Magyars (pronounced Mă-jārs), who occupy the great plains watered by the Danube and Theiss. One of these plains is known as the "Great Alföld," of which Budapest is the metropolis. It is said to be the largest plain in Europe, and extends to 37,000 square miles. The other plain is the "Little Alföld," to the east of Pressburg. These plains are of moderate elevation, contain very fertile alluvial soil, produce large crops of grain, and feed immense numbers of live stock. They constitute Hungary one of the leading agricultural countries of the world.

In Transylvania, at the extreme south-eastern corner of the monarchy, around the Alt and other rivers, is a district also occupied by the Magyars, but the land there is generally at a considerable altitude.

The country of the Magyars, comprising the two great plains already referred to, forms the central axis of the Austro-Hungarian monarchy, and round it the other races are grouped. To the west the country of the Germans stretches from the vicinity of Pressburg to the confines of Tyrol. To the north the country of the Czechs and Slovaks stretches from Schemnitz to Prague. To the north-east the country of the Ruthenians stretches from Ungvar to Russia. To the south-east the country of the Roumanians stretches from the Danube to Russia. To the south-west the country of the Croats and Servians stretches from the River Drave to the Adriatic, while the country of the Slovenes stretches from Marburg to Trieste.

Outlying racial settlements are those of the Poles, situated between the Carpathians and Russian Poland; the detached portion of Magyarland in Transylvania already referred to; and German settlements round Kronstadt, Schässburg, Hermannstadt, and elsewhere in Transylvania and Hungary, Gottschee to the east of Trieste, and all along the frontier between Austria and Germany.

As has been already said, the political division of Austria-Hungary into two halves and a number of provinces was entirely artificial, and gave no effect to ethnical considerations. Possibly the originators of that division, acting on the principle *Divide et impera*, desired to break up the various nationalities rather than to consolidate them by giving each a separate province. At all events, they succeeded in spreading the various races over the various provinces in a most heterogeneous and confusing manner. Thus the province of Tyrol is German in the north and Italian in the south. Bohemia and Moravia are Czech and Slovak in the centre and German in the north and west. Silesia is German in the west, Czech and Slovak in the centre, and Polish in the east. Galicia is Polish in the west and Ruthenian in the east. Bukowina is partly Ruthenian, partly Roumanian. Transylvania is Magyar in the east, German in the centre, and Roumanian in the west and south. Hungary proper is Roumanian in the east, Magyar and German in the centre, Czech, Slovak, and Ruthenian in the north, and German, Servian, and Croat in the south. Styria and Carinthia are German in the north and centre and Slovene in the south. Carniola is Slovene in the north and centre and German in the south. Kustenland is Slovene in the north, Friaulian in the west, and Servian, Croat, and Italian in the south. The only provinces where there is an approach to

ethnical homogeneity are the German provinces of Upper and Lower Austria and Salzburg; and the Servian-Croatian provinces of Croatia and Slavonia and Dalmatia, with the Servian-Croatian administrations of Bosnia, Herzegovina, and Novi Bazar.

Some years ago a well-known writer startled Europe by predicting that the German race would never rest until it had pushed its empire southwards and had reached the Adriatic. A glance at an ethnical map, however, proves that there are grave racial obstacles in the path of any such Teutonic development, for the territory between the German Austrian provinces and the Adriatic is occupied by Slavonic and Italian races which would not be likely to welcome, or give way before, invaders of German origin. The truth is that Austria-Hungary consists of a wonderful collection of diverse races, each holding its place as each manages to keep it; and there is, as yet, no sign that the German race is gaining ground in the monarchy at the expense of any other race.

The following is a tolerably complete list of the various races inhabiting Austria-Hungary :—

Races.	In what Provinces found.
1. Germans.	Austria, Tyrol, Styria, Carinthia, Carniola, Bohemia, Moravia, Silesia, Hungary, Transylvania.
2. Magyars.	Hungary, Transylvania.
3. Czechs.	Bohemia, Moravia, Silesia, Hungary.
4. Slovaks.	do. do. do.
5. Ruthenians.	Galicia, Hungary.
6. Roumanians.	Hungary, Transylvania, Bukowina.
7. Croats.	Croatia, Slavonia, Hungary, Bosnia, Herzegovina, Novi Bazar, Dalmatia, Istria.
8. Servians.	Do. do. do.
9. Slovenes.	Carniola, Styria, Carinthia.
10. Poles.	Galicia, Silesia.
11. Bulgarians.	Hungary.
12. Friaulians.	Kustenland.
13. Ladinians.	Tyrol.
14. Italians.	Tyrol, Kustenland.
15. Armenians.	Transylvania, Hungary.
16. Albanians.	Bosnia.
17. Jews.	Widely diffused.
18. Gipsies.	Hungary, Transylvania.

The above races have been grouped by Freiherr C. von Czoernig in his *Völker und Sprachen-Karte der Œsterreichisch-Ungarischen Monarchie* as follows :—

Race.	Family.
Germans.	German.
Czechs and Slovaks.	North Slav.
Poles.	
Ruthenians, or Little Russians.	

Race.	Family.
Slovenes.	South Slav.
Servians and Croats.	
Bulgarians.	
Moldo-Wallachians.	East Roumanian.
Italians.	West Roumanian.
Friaulians.	
Ladinians.	
Magyars.	Magyar.
Armenians.	Iranian.
Albanians.	Thraco-Illyrian.

Effect has been given to Czoernig's ethnical views in localising the various races in the accompanying map.

Dr. Josef v. Jekelfalussy, Secretary in the Royal Hungarian Government's Statistical Land Office, in an article on the "Nationalitätenverhältnisse der Länder der ungarischen Krone," which appeared in *Petermann's Mitteilungen* (31 Band, 1885, p. 42), eulogised Czoernig's "great ethnographic work, in which the relations of the various nationalities of Hungary were treated in a detailed and scientific manner." This article was illustrated by an ethnographic map of Hungary, based on the census of 1880, constructed by M. Ignaz Hátsek, Royal Hungarian Cartographer. A comparison of this map with one after Czoernig, which was given in Herr V. von Haardt's *Physical-Statistical School Atlas*, published at Vienna in 1889, shows that both Czoernig and Hátsek were practically agreed as to the leading features of the ethnography of Hungary.

Of all the peoples of the Austro-Hungarian monarchy, the Magyars have always most attracted the attention and sympathy of Britain. Their ancient and romantic history, their wars of Independence culminating in victory, their intelligent, progressive, and energetic character, and the fact that they stand there alone between the hammer and anvil of two vast conflicting empires, the Teutonic and the Slavonic, have given to this gallant little nation of eight and three-quarter millions a peculiar interest in the eyes of British observers.

There is a marked relation between the ethnology, orography, meteorology, and geology of the country occupied by the Magyars, for the vast alluvial plains where they chiefly reside belong to the most modern geological period and, owing to their comparatively low altitude and distance from mountains, the rainfall is generally less than that of the rest of the monarchy. The conditions and situation of Magyar-land are thus peculiarly favourable to agriculture and commerce, for, while its soil is eminently fertile, its climate genial, and its population intelligent and laborious, its great waterways, the Danube and Theiss, ensure cheap and easy transit, and the level nature of the plains favours the construction of roads and railways.

The possession of these fertile plains is one cause of the prominence and prosperity of the Magyars; another, and one as important, is the character of the race. The Magyars are of Turanian origin, and their

language, which is so unintelligible to foreigners, proves their origin, for Professor Vambéry informed me, when I visited Budapest last spring, that whoever knew Turkish would have little difficulty in acquiring Magyar.

However Turanian the origin of the Magyars may be, they have none of that fatal indolence, religious intolerance, and antipathy to progress which distinguishes the Turks. On the contrary, they are an exceedingly active, intelligent, and enterprising race, and, unlike the majority of Austrians, they allow Protestants and Jews the same liberty, status, and protection as Roman Catholics. In their intelligence and energy they resemble the Prussians of the German Empire, and, like them, they are a ruling race and have no intention of yielding to any other race.

Owing to their progressive and truly liberal qualities, the Magyars have long enjoyed the friendship of Britain; and from an interview I had with M. Franz Kossuth, the son of the well-known patriot, I found that the Magyars still prize the hereditary friendship existing between his and our countrymen. The English language is taught to children in all Magyar families of standing, and in Budapest there are at present five hundred Englishwomen engaged as governesses and nurses for this purpose. I need hardly add that, having spent his childhood in England with his exiled father, M. Franz Kossuth, a prominent political figure in Hungary, speaks English fluently.

The great aim of the Magyars being to retain exclusive political control of Hungary, they proscribe German and substitute Magyar terms. Thus, on entering Hungary by railway, we find "Pressburg" transformed into "Pozsony" and Magyar conductors taking possession of the train. Members of non-Magyar races resident in Hungary and desiring to be popular with its ruling race, Magyarise their names often past recognition. So insistent are Magyars that German shall not seem to be their language (although, doubtless, they know it very well) that when M. Franz Kossuth, as leader of the Hungarian Coalition party, met the Emperor-King Franz Joseph lately at Vienna, he addressed his sovereign in French. The jealousy felt by Magyars towards the Austrian Germans and their determination to be independent could not have been more strongly evinced.

So active and enterprising are the Magyars, that their capital Budapest is actually beginning to shake the supremacy of the Imperial city of Vienna. The magnificence of some of the new buildings in the former is not surpassed by those in the latter, while in grandeur and picturesqueness the site occupied by Budapest is comparable with that of only one city, Edinburgh, but the latter has no splendid Danube flowing through its midst. The population of Budapest leapt up from 201,911 in 1869 to 732,322 in 1900, and there is every promise of its increase in wealth and prosperity provided peaceful government is assured. I was much struck with the number of book-shops in Budapest—always a good sign in a city.

While there are only a little over two million Germans in Hungary, there are over nine million Germans in Austria, making more than

eleven millions in all. These belong to the same stock as the South Germans of the German Empire and, although their manners may be more agreeable than those of the North Germans, they lack the latter's remarkable energy and sterling business qualities. At the same time, aided by the influence of the reigning German Imperial House of Austria, Austria-Hungary has politically been long subject to German authority, and the German language is ubiquitous, although each race prefers and preserves its own.

As has been previously pointed out, the predominant race in Austria-Hungary is the Slav, which numbers in all over twenty-two millions, or more than two millions more than the Germans and Magyars united. Yet hitherto the two latter have been the "ruling races" of Austria-Hungary, exercising authority over the less cultured Slavs as the Normans did over the Anglo-Saxons, or as the English of the Pale did over the native Irish.

But a great movement is in progress at present which may considerably alter the relations of the Slav towards his whilom masters, the German and the Magyar. By this movement, which is said to have received the support of the Emperor-King, the Slavs are to be enfranchised by the introduction of universal suffrage, and are to stand on an equal political footing with the Germans and Magyars. What will be the result? Will Austria-Hungary become politically, what it is ethnically, a Slavonic power? or will the German and Magyar, laying aside their mutual jealousies, combine with each other and with the Roumanian and Italian, to prevent the Slav obtaining, what he has never yet had, the political control of Austria-Hungary?

Count Stephen Tisza, Magyar Prime Minister of Hungary from 1903 to 1905, is said to have predicted that the Magyars would lose their hegemony if universal suffrage were introduced into Hungary.[1] There are only eight and three-quarter millions of Magyars in Hungary out of a total population of nineteen and a quarter millions. If this prediction were true of the Magyars in Hungary, it would also be true that the Germans would lose their hegemony in Austria. There are only nine millions of Germans in Austria out of a total population of twenty-six millions.

If the Magyars lost command of Hungary and the Germans of Austria as the result of the proposed universal suffrage, the Slavs, who outnumber by over two millions the Magyars and Germans combined, would succeed to the hegemony of Austria-Hungary, which would then become consolidated as a great Slavonic power instead of being, as at present, a Dual State with the weakness and discord which all such states

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[1] Addressing his constituents at Szombathely in December 1905, Count Julius Andrassy (a leading member of the Magyar Coalition party) declared that he did not accept the programme of the Government regarding universal suffrage. While desirous of the extension of the franchise to the working classes, he did not consider it in the interests of the country to allow new and inexperienced elements to exercise the decisive influence and supplant the intelligent class in control of public affairs. Moreover, such sweeping reform as that advocated by the Government might, without having passed through a transition stage, be fraught with danger to the present character of the Magyar nation.

must experience. It is difficult, however, to imagine that the astute old Emperor-King, who has piloted his multi-divided empire through so many vicissitudes, would sanction universal suffrage throughout Austria-Hungary if he thought that the hegemony of the Germans, to whom his proud House of Hapsburg belongs, would be shaken by that of any other race. It is more probable that, if he sanctions universal suffrage, it will be in the belief that his empire would thereby be brought more surely than ever under the hegemony of the Germans who have swayed it for so many centuries.

THE GREAT PLAINS OF THE CENTRAL UNITED STATES.

(With Illustrations.)[1]

THE general characters of the Great Plains, which cover so many thousand miles of area in the central region of the United States, are familiar to all students of physical geography, and all are probably also aware that though in many parts the plains afford valuable pasture ground, yet the region in general suffers from lack of water. Over many parts, indeed, definitely arid conditions prevail, and apart even from irrigation questions, there is great want of water for ordinary domestic use. Of recent years many artesian bores have been put down, and copious supplies of water obtained at relatively small depths, but a further development of well waters is an essential for the future prosperity of the district. In order that this may take place it is important that the geology of the district be fully studied, especially in connection with the flow of underground waters. This task has engaged the attention of the U.S.A. Geological Survey for the past eight years, and the results are summed up by Mr. N. H. Darton in a well-illustrated quarto volume,[2] which contains not only the results of Mr. Darton's own investigations, but also brings together all available data on the subject.

The area to which the report relates comprises the greater portions of South Dakota, Nebraska, and Kansas, and the eastern portion of Colorado and of Wyoming, and includes a total area of about half a million square miles. Although such a vast area naturally includes very diverse geological conditions, yet comparatively few formations are included, and these are very widespread. By definition the Great Plains province is that part of the continental slope which extends from the foot of the Rocky Mountains eastward to the valley of the Mississippi. Here it merges into the prairies on the north, and on the south into the low plains adjoining the Gulf Coast and the embayment of the Missis-

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[1] We are indebted to the U.S.A. Geological Survey for the photographs from which the blocks of figures 1, 2, 5 and 6 have been made.

[2] *Preliminary Report on the Geology and Underground Water-Resources of the Central Great Plains.* By W. H. Darton, U.S.A. Geological Survey, Washington, 1905.

sippi. In general appearance the plains present wide areas of tabular surfaces, which are traversed by the broad shallow valleys of the large rivers, arising mainly in the Rocky Mountains, and are more or less deeply cut by the narrower valleys of the lateral streams. In the most general case the region is characterised by smooth surfaces and eastward rolling plains, but in portions of the province there are buttes, extended escarpments, and local areas of badlands, as well as wide areas of sand dunes, which in western Nebraska cover an area of several thousand square miles.

As regards altitudes and slopes, the province as a whole descends to the east about 10 feet in each mile from altitudes of about 6000 feet at

FIG. 1.—Toadstool Park in Badlands, west of Adelia, Nebraska. The rocks are sandstones overlain by Brule clay (Tertiary).—*After Darton.*

the foot of the Rocky Mountains to those of about 1000 feet near the Mississippi River. The altitudes and rate of slope vary considerably in different districts, particularly to the north, along the middle course of the Missouri River, where the general level has been greatly reduced. West of Denver the central plains have an altitude of 6200 feet at the foot of the Rocky Mountains, and this elevation is sustained far to the north along the foot of the Laramie Mountains. High altitudes are also attained at Pine Ridge, a great escarpment which extends from near the north end of the Laramie Mountains eastward through Wyoming, across the north-west corner of Nebraska, and for many miles into southern South Dakota. Pine Ridge indeed marks the northern margin of the higher levels of the Great Plains, and presents cliffs and steep slopes descending a thousand feet into the drainage basin of Cheyenne River,

one of the most important branches of the Missouri. From this basin northward there is a succession of other basins with relatively low intervening divides, which do not attain the high level of the Great Plains to the south.

The great range of the Rocky Mountains rises abruptly out of the plains in a front range which rises on an average about 5000 feet above the adjoining lowlands, with some of the higher summits rising to much greater elevations. The Black Hills rise gradually out of the plains in western South Dakota and eastern Wyoming, and present mountainous summits about 4000 feet higher than the adjoining plains. The Bighorn

FIG. 2.—"Jail Rock," made of soft sandstone resting on Brule clay. North Platte Valley.—*After Darton.*

Mountains rise steeply, and have about the same relative prominence as the Rocky Mountain Front Range.

As regards drainage, the northern portion of the Great Plains is drained by the middle branches of the Missouri River, of which the larger members are the Yellowstone, Powder, Little Missouri, Grand, Cannonball, Owl, Cheyenne, Bad and White Rivers. On the summit of Pine Ridge, not far south of the escarpment, is the Niobrara River, which rises in the plains some distance east of the north end of the Laramie Mountains. To the south are the Platte with two large branches heading far back in the Rocky Mountains, the Rio Grande, and the Arkansas, the two last crossing the plains to the south-east and affording an outlet for the drainage of a large watershed of mountains and plains. Between the Rio Grande and the Arkansas lie the Cimarron River and numerous smaller streams heading in the western portion of the plains.

Between the Arkansas and the Platte rivers is the Republican, rising near the one hundred and fifth meridian, and an extended system of local drainage in eastern Kansas and Nebraska.

The Central Great Plains, as is to be expected from the large area, present considerable variation in regard to climate. To the east on the plains the precipitation varies from moderately humid to nearly arid, the change taking place gradually from east to west. To the east the mean annual precipitation is 40 inches, while to the west in the region adjoining the Rocky Mountains and other ranges the figure sinks to 12 inches per annum, and this over an area of considerable extent. To the east the precipitation is ample for crops, and that portion is one of the greatest producers of corn, wheat, and other agricultural products in the world, while to the west there are broad tracts in which no crops can be produced without irrigation. On the mountains in the western portion of the region there is locally increased precipitation, which in many areas

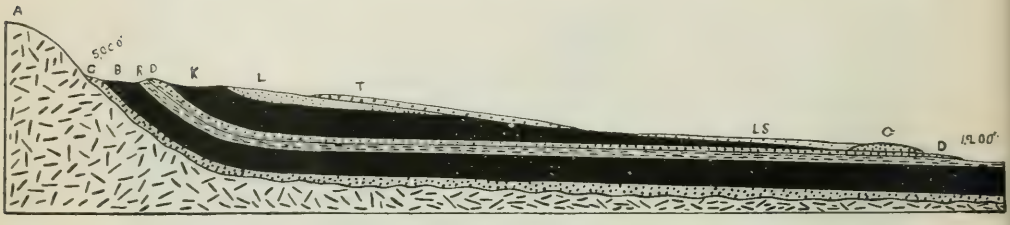

FIG. 3.—Simplified section across the Central Great Plains to show the main points in regard to geological structure. **A**. Mountains, composed of granite and schists. **C**. Cambrian sandstone. **B**. Carboniferous and Ordovician limestones, with local sandstone beds. **R**. "Red beds," probably Permian and Triassic. **D**. Dakota-Lakota sandstones. **K**. Benton, Niobrara, and Pierre formations, chiefly shale. **L**. Sandstone, etc., of Laramie and Fox Hills formations: all these beds from the Dakota-Lakota sandstones upwards appear to be of Cretaceous age. **T**. Tertiary deposits, partly sandstones. **LS**. Loess, underlain by gravel. **G**. Glacial drift.—*After Darton, slightly modified.*

is sufficient for agriculture. The amount of water that falls in the arid area is enormous when the number of cubic feet per square mile is calculated, but much of it comes in very heavy showers, after long intervals of drought, often with severe hot winds. If a portion of this rainfall could be stored much of it could be used for irrigation.

Evaporation also increases rapidly in amount from east to west in nearly inverse ratio to the precipitation. Its estimated amount is three feet in the eastern portion of the region and six feet in the western including the mountains. This large amount of evaporation in the arid belt is a serious consideration in the storage of water for irrigation.

The mean annual temperature falls gradually in going from north to south, and rapidly in ascending the mountain slopes. The entire region receives more or less snow in winter, the amount diminishing in the arid plains to the westward and increasing very greatly on the high mountains, amounting to several feet in portions of the latter. On the western plains, owing to the clearness of the atmosphere, the sun's heat is more intense during the day than in the region eastward. For the

same reason, and also because of the increased evaporation, the nights are cooler and in general the heat less oppressive.

As regards general geologic features, before proceeding to mention some details, we may sum up in Mr. Darton's words the general conditions which prevail. The province is developed on a great thickness of soft rocks, sands, clays and loams, in thin but extensive beds sloping gently eastward with the general slope of the plains. These deposits lie on relatively smooth surfaces of the older rocks. The materials of the formations were derived mainly from the west, and were deposited layer by layer, during earlier times in the sea, and later either by streams on their flood plains, or in lakes. Aside from a few local flexures, the region has not been subjected to folding, but has been broadly uplifted and depressed successively. The general smoothness of the region today was surpassed by the apparently almost complete planations of the surface during earlier epochs. Owing to the great breadth of the plains

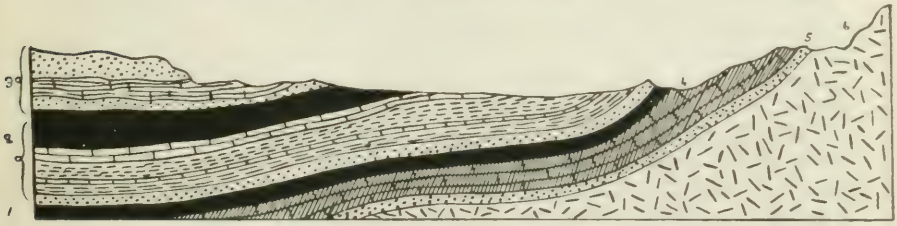

FIG. 4.—Section from Black Hills (right) to Pine Ridge (left) across Fall River Country, showing relations of water-bearing beds. **1.** Juratrias beds. **2.** Cretaceous beds; the lowest is the Dakota sandstone, above lie in order the Benton shales and limestones, the Niobrara chalk and the Pierre shale. **3.** Tertiary beds, including the Chadron sand, the Brule clay, and the Loup Fork sands and sandstones. **4.** Carboniferous limestone. **5.** Cambrian sandstone. **6.** Granite of Black Hills uplift.—*After Darton, slightly modified.*

and their relative gentle declivity, general erosion has progressed slowly in spite of the softness of the formations, and as at times of freshet many of the rivers bring out of the mountains a larger load of sediment than they can carry to the Mississippi, their valleys are now being built up rather than deepened.

In detail the geology shows a most interesting relation to the surface relief. Apart from the Rocky Mountains which, as indicated above, bound the area on the west, the high ground of the region may be said to consist chiefly of the Black Hills, the Bighorn Mountains, the Laramie Mountains, and the Pine Ridge escarpment. Leaving the latter out of consideration for a moment we find that the others have essentially the same structure, consisting of a central core of granites and schists, against which the sedimentary beds of the various formations are uplifted in order. A brief account of the geology of the Black Hills region may serve to make the general conditions clear.

The Black Hills uplift is an irregular dome-shaped anticline, embracing in its more obvious features an oval area 125 miles in length and 60 miles in breadth, with its longer dimension lying nearly north-

west and south-east. It is situated in a wide area of nearly horizontal beds underlying the great east-sloping plains that extend from the Rocky Mountains to the Mississippi, and has brought above the general level of the plains an area of pre-Cambrian crystalline rocks about which there is upturned a nearly complete sequence of the Palaeozoic and Mesozoic rocks from Cambrian to Laramie (Cretaceous), all dipping away from the central nucleus. There are also extensive overlaps of the Tertiary deposits which underlie much of the adjoining plains area. The structure presented locally on the sides of the uplift is that of a monocline dipping towards the plains. The oldest sedimentary rocks constitute the escarpment facing the crystalline rock area, and each stratum passes beneath the younger one in regular succession towards the margin of the uplift. The sedimentary members consist of a series of thick sheets of sandstones, limestones, and shales, all of which are essentially conformable in succession, except the overlapping areas of the Tertiary deposits, which extend across the edges of the older formations. The accompanying diagrams indicate the general relation of the deposits of the plains to those of the mountains throughout the area, and further help to make clear the problem of the artesian waters of the district.

The origin of the Pine Ridge escarpment is interesting. During Tertiary and early Pleistocene times there was extensive uplift in the Black Hills region, and as the dome of the hills rose somewhat higher than the general uplift there was extensive erosion around it, so that the High Plains were largely removed, and their northern edge left, as at present, in the great escarpment of Pine Ridge facing towards the Black Hills uplift.

As the structure of the Bighorns and Laramie Range is in essentials the same as that of the Black Hills it is unnecessary to describe them. As to the plains themselves they are covered with sedimentary deposits, lying approximately horizontally, the surface beds being over large areas Cretaceous, or Tertiary, while in many regions the underlying deposits are concealed by thick beds of glacial drift or loess (cf. diagram, p. 12).

From the point of view of irrigation, and thus of the future prosperity and development of the region, the nature of the beds is of extreme importance. As the diagram shows the beds are uplifted against the mountainous regions to the west, and as the rainfall is greatest in the mountain regions the sandstones and other porous beds here returned to the surface carry large amounts of water, which flows eastward through the permeable beds, and in most cases escapes finally in springs in the low level areas of outcrop eastward and southward. As the permeable beds are for the most part covered in the plains by a thick mantle of younger impermeable beds, and as there is a difference of three to five thousand feet between the intake zone and the region of outflow, the water in the permeable beds is naturally under great pressure, and will in consequence rise in artesian bores. The pressure in these bores is indeed often great, for several wells show surface pressures of over 175 pounds to the square inch, and two are slightly over 200 pounds, the latter indicating a pressure of over 780 pounds at the bottom of the well. Mr.

Darton gives illustrations of some of these wells showing the great flow of water obtained. One at Woonsocket, South Dakota, throws a 3-inch stream to a height of 97 feet, while another at Springfield gives a flow of 3292 gallons per minute. The most valuable water-horizon is in beds of Cretaceous origin known as the Dakota sandstones, and there are extensive areas underlain by this deposit in which the underground water resources have as yet not been developed. The water in this formation, as indicated above, lies under great pressure, the Springfield well mentioned furnishing power for a 60-barrel flour mill by day, and for an electric-lighting plant by night. In addition there are other water horizons, some of which however lie too deep for economic boring. The following is a brief summary of the different geological formations of the area in relation to the possibilities of water development.

The basal sedimentary deposits of the whole region are sandstones of Cambrian age, which probably contain water. They outcrop extensively in the uplifts of the Bighorn Mountains and the Black Hills, and have been reached by some of the deep wells in the lower Missouri valley, but owing to the great depth at which they lie in the central region nothing is known of their relations or capabilities. These sandstones are never likely to be of economic importance as regards water, except possibly in a few districts immediately adjoining the Black Hills. The Ordovician rocks in the Bighorn Mountains, northern part of the Black Hills and west of Colorado springs, are mostly limestones not likely to contain water, and their steep dips soon carry them below the surface.

Rocks of Carboniferous age probably underlie the plains throughout the greater part of their area, but in most parts they lie too deep for wells. In the vicinity of the Black Hills and elsewhere they occur within a moderate distance from the surface, and consist of water-bearing sandstones in addition to limestones, and these may yield water for deep wells. In some regions, however, where Carboniferous sandstones have been tapped their water has proved too saline for use. As regards the Jurassic beds, in the vicinity of the Black Hills again, there is found a water-bearing sandstone of this age of some importance.

It is, however, the Cretaceous beds which are of most importance, and this largely because of the alternation of permeable and impermeable beds. The most important member of the series is the Dakota-Lakota formation, which extends beneath the entire area in a sheet generally from 150-300 feet thick, and is overlain by a great mass of impermeable clays and shales belonging to the Benton, Niobrara and Pierre formations (see diagram, p. 13). The sandstones outcrop extensively along the uplifts of the Bighorns, Black Hills, and the Rocky Mountain front ranges, and in the Arkansas valley in southern Colorado, where they receive large volumes of water not only directly from the rainfull but by the sinking of water from streams.

In South Dakota the sandstone carries a large volume of water which has been extensively utilised by artesian wells. This water is under pressure so great that in the eastern portion of the state flows are obtainable in all but the very highest lands, except in the south-east corner, near the zone where the head is lost by the sandstone reaching

the surface. Over a thousand deep wells have been sunk east of the Missouri river, most of which are from 500 to 1000 feet deep, and generally yield a supply of flowing water much of which is used for irrigation. The aggregate flow from these wells is estimated at about 7,000,000 gallons per day. The source of the water is believed to be in the Black Hills and in the Rocky Mountains.

Above the Pierre shale lies the Fox Hills—Laramie group, which form the surface beds over a considerable part of the area. These beds

Fig. 5.—Gateway to Perry Park, Colorado. The rocks in the foreground are red grits of Permian (?) age; in the background are cliffs of Dakota sandstone lying on shale.—*After Darton.*

contain sandstones which carry a considerable amount of water, though artesian flows are only obtainable in restricted areas.

In the extensive Tertiary deposits of the Great Plains there are numerous beds of conglomerates and coarse sandstones which yield large amounts of water, but in most cases this requires to be pumped, and there is no artesian flow.

As to Post-tertiary beds, a greater or less quantity of water is contained in the alluvial deposits along the streams in the gravel deposits underlying the loess in central and east Nebraska, in the glacial deposits of east South Dakota and east Nebraska, and in the various sandhill

Fig. 6.—Eroded Tertiary Sandstones, Monument Park, Colorado.—*After Darton.*

districts. The waters in the alluvial deposits afford the principal water supplies of the Great Plains regions, for most wells are in the valleys. These obtain water at depths from 5 to 50 feet in most cases, drawing supplies either from the underflow of a surface stream or from a sunken watercourse, or from sheet water in the alluvium. In the more arid regions to the west these waters often contain alkali in greater or less proportion. The waters in the gravel beds beneath the loess are available under many thousand square miles in central Nebraska, mostly at depths of from 30 to 50 feet, and afford very satisfactory supplies. The waters of the glacial drift occur mainly at the base of the till, at depths varying from 100 to 300 feet for the most part, and these waters are the principal sources of supply for tubular wells in portions of eastern South Dakota, and to a considerable extent in East Nebraska. In the sandhill districts nearly all the water that falls sinks into the ground and, at many localities, especially in central Nebraska, is found available in large amounts in wells from 5 to 100 feet deep.

This brief summary of a very interesting volume may serve to indicate the nature of the connection between the details of the geological structure of the Central Great Plains region and the future geographical development of the area, a development which is bound up with the problem of obtaining water.

A BRIEF DESCRIPTION OF THE ORDNANCE SURVEY,[1]

And some Notes on the Advantages of a Topographical Survey of South Africa.

By Colonel Duncan Johnston, C.B., R.E.

(*With Illustrations.*)

This paper aims at giving, in the short time at my disposal, a simple account of the Ordnance Survey, including:

(1) A short description of what it has done to ensure a scientifically accurate framework on which to base the detail Survey.

(2) A description of the present organisation and work of the Ordnance Survey, with some indication of the care taken and the checks employed to ensure accuracy.

(3) Finally, I should like to give a practical turn to the paper by a few remarks on the advantages of a topographical survey to colonies which cannot afford an elaborate survey like that of the Ordnance Survey.

The Ordnance Survey is intrusted with the duty of surveying and

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[1] A Paper read before the South African Meeting of the British Association.

preparing both topographical and cadastral maps of the United Kingdom. The term "Cadastral" requires some explanation. It is derived from the French "Cadastre." The 6-inch and larger scale maps are usually spoken of as "Cadastral," and are suitable for property or land transfer purposes; although they have only exceptionally been used for the latter purpose, they are largely used for business purposes connected with land.

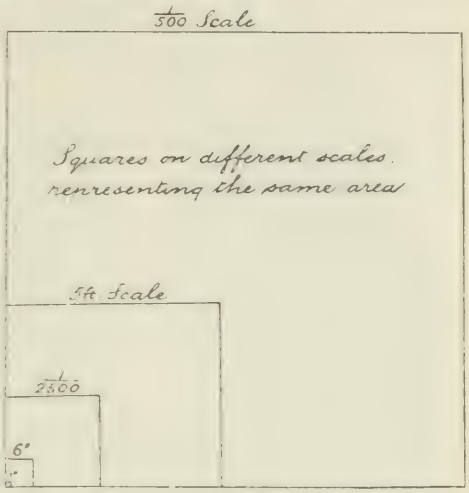


FIG. 1.—Diagram representing the same area on different scales.

The survey of the United Kingdom has been completed, but it is periodically revised and brought up to date.

The organisation of the Ordnance Survey is and always has been military. Although it is now under the Board of Agriculture and Fisheries it was, when started, under the Board of Ordnance, from which it derives its name, and remained under that Board till it was dissolved. The Director-General and all the officers are Royal Engineers on the active list, and four companies of Royal Engineers are employed on the Survey. The officers and men of the Royal Engineers are fully trained in military duties; they are available as troops in case of war, and have definite duties assigned them on mobilisation. Besides the Royal Engineers a number of civil assistants and labourers have since early times been employed on the Ordnance Survey.

The work of the Ordnance Survey actually commenced in 1784. In that year it was decided for scientific purposes to connect Greenwich and Paris by triangulation, and work was commenced by measuring a base line on Hounslow Heath. Great scientific interest was taken in the work, which was visited by the King, the President of the Royal Society, and by many men of science. The measurement was made with the minutest accuracy possible, and every care was taken to eliminate, as far as possible, all error.

Without following the further history of the Survey in detail, it may be said that, in 1855, a Treasury Order was issued in which the following scales were laid down:—

$\frac{1}{500}$ *scale or* 10·56 *feet to a mile* for towns of 4000 inhabitants and over.

$\frac{1}{2500}$ *scale or* 25·344 *inches to a mile* for cultivated districts.

$\frac{1}{10560}$ *or* 6 *inches to a mile* for the whole country.

$\frac{1}{63360}$ *or* 1 *inch to a mile* for the whole country.

In order to illustrate more clearly the difference between these scales, I may say, that a $\frac{1}{500}$ scale plan size about 38×25 inches only takes in 38·4 acres. A $\frac{1}{2500}$ scale map of the same size takes in 960 acres. A slightly smaller 6-inch map takes in 15,360 acres, while a 1-inch map of the same size as the latter takes in 552,960 acres. These scales, decided on fifty years ago, have been adhered to ever since, but $\frac{1}{500}$ scale maps are now only made at the expense of the locality. Some additional scales have been since adopted, especially the 2-mile, 4-mile, 10-mile and $\frac{1}{1000000}$ scale.

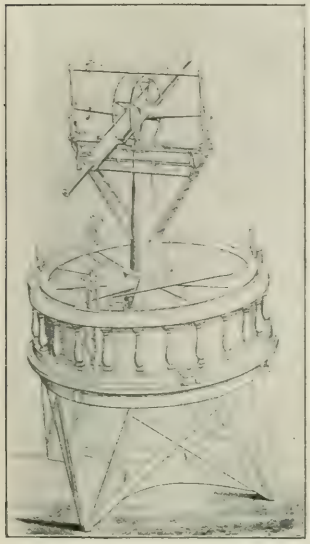


Fig. 2.—Ramsden's 3-feet Theodolite.

I will now proceed to describe how the Survey was made.

The first step is the measurement of a base line, and as the triangulation and the whole survey depends on the base line, this must be measured with the most minute accuracy possible.

The early heads of the Survey showed great foresight in this matter, and no pains were spared to measure the base lines and carry out the triangulation with the most scientific accuracy possible, and the Ordnance Survey ever since has endeavoured in all its work to maintain a high standard of accuracy.

It would be beyond the scope of this paper to describe the work of laying down accurate standards of length or to give details of the actual measurement of the base lines, but I may say that the latter were measured with deal rods, glass rods, steel chains, and, finally, with Colby's compensation bars. These bars, invented by Major-General Colby, were very ingenious. They were made of iron and brass which have different degrees of expansion, and were so constructed that the points from which measurements were taken are practically unaffected by temperature.

In the course of the Survey the following base lines were measured :—

In 1784 and 1791,	Hounslow Heath.	Length	27,406	feet.
„ 1794, . .	Salisbury Plain.	„	36,576·6	„
„ 1801, . .	Misterton Carr.	„	26,344	„
„ 1806, . .	Rhuddlan Marsh.	„	24,516	„
„ 1817, . .	Belhelvie Sands.	„	26,518	„
„ 1827, . .	Lough Foyle.	„	41,641	„

Finally, in 1849, the Salisbury Plain base was remeasured and found to be 36,577·8 feet. This latter measurement was adopted in

calculating the triangulation, and the other bases were used as check base-lines.

From the ends of the base lines at Hounslow and Salisbury Plain the triangulation was extended, and covered the country with a network of triangles. There were about 250 primary stations. The mean length of the side of a primary triangle is 35·4 miles, and there are eleven

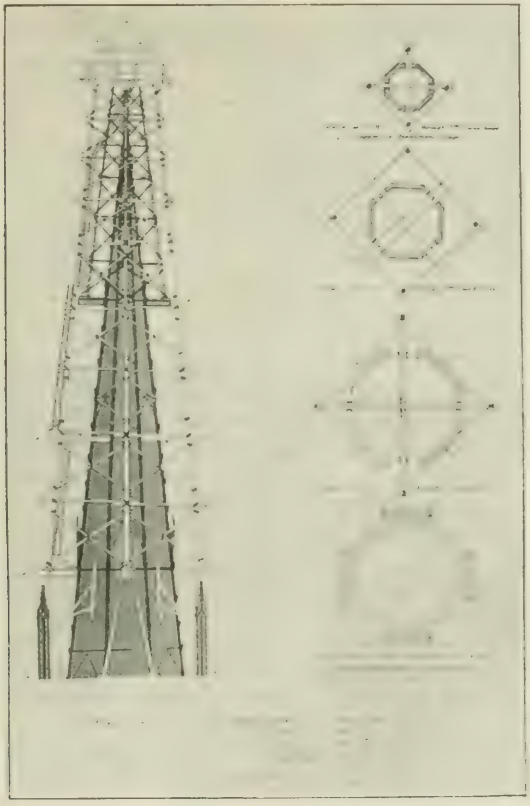


Fig. 3.—Observer's Scaffold on Church Tower.

lines over 100 miles long, the longest being that from Slieve Donard to Sca Fell, which is 111 miles long. The primary triangulation was carried out with 5-feet, 2-feet, and 18-inch theodolites. Ramsden's 3-feet theodolites were in their day considered marvels of accuracy. Modern instruments of much smaller size are now made with which even more accurate work can be done.

The 2-feet theodolite was made by Troughton and Simons, and was in its day an excellent instrument.

The latitudes of 32 primary stations were taken with Ramsden's zenith sector and Airy's zenith sector.

Of all branches of the Survey that of triangulation, especially of the primary triangulation, is the most interesting. There is a fascination about the combination of the great distances to be dealt with and the minute accuracy required. The difficulty of picking up a signal, possibly 100 miles distant, was very great, and entailed watchfulness and often great privations. The observer, isolated on a distant hill-top, had sometimes to wait for weeks, and often watch late into the night for the distant signal.

The difficulties which had to be overcome in a wooded and populous country, like the United Kingdom, were very great, and scaffolds had often to be built in order to give the observer a clear range of view. Some of the scaffolds built were very ingenious.

In all cases the scaffold for the instrument is separate from that for the observer, in order to avoid any vibration to the instrument. As circumstances vary very greatly, each scaffold had to be separately designed. These scaffolds look small on the screen or on paper, but when built on a high tower or spire it requires great skill and nerve, and a good head, to construct or even to use them. At such heights wind is much felt.

Mist, fog, smoke, and vibration through heat are great hindrances to observers. In 1890-91 the difficulties from these causes in the triangulation of London were very great. Even on a bright day it was difficult to see any distance owing to the smoke in the air, and points at any considerable distance could only be observed in the early morning before fires were generally lighted. In the winter, sometimes for several weeks together, no observations could be taken.

Again, in towns ground-stations are necessary as well as up-stations, such as church towers, etc. The lines into these ground-stations necessarily run through houses and other buildings, and the difficulty arising from this cause is very great.

Apart from the well-known fact that, starting from the Lough Foyle base, the measured and computed lengths of the Salisbury Plain base differed only by 5 inches, it may be mentioned that in the case of three other check base-lines the difference between the measured and the computed length was only about 3 inches; in that of the Rhuddlan Marsh base-line, however, the difference was about 18 inches.

The average probable angular error of the primary triangulation was at the time considered satisfactory, but modern science has admitted of much greater accuracy than in the past, and in the following table, showing the accuracy of triangulation of different countries, it will be seen that the Ordnance Survey comes at the bottom:—

Table of Relative Accuracy of Triangulations in various Countries.

(Copied from General Ferrero's Table.)

STATES.	Epoch.	Number of Triangles.	Mean Errors.
			"
Danemark, . . .	1867-70	16	0·4
Saxe, ...	1867-77	197	0·4
France, ...	1884-91	186	0·6
Prusse (B), . . .	1832-91	690	0·6
Norvège, . . .	1853-63	179	0·7
Prusse (A), . . .	1860-82	137	0·7
Würtemberg, . .	1861-67	1	0·7
Danemark, . . .	1817-24	20	0·8
Greece, ...	1890-92	102	0·8
Autriche-Hongrie, .	1862-88	670	0·9
Belgique, . . .	1853-73	219	0·9
Espagne, . . .	1861-84	235	0·9
France, ...	1860-72	157	0·9
Italie, ...	1863-88	514	0·9
Suisse, ...	1861-67	40	0·9
Sumatra, . . .	1884-91	56	0·9
Danemark, . . .	1837-47	51	1·0
Île de Java, . . .	1861-78	68	1·1
Mecklembourg, . .	1818-60	69	1·1
Suède, ...	1832-84	304	1·1
Russie, ...	1830-88	998	1·2
Portugal, . . .	1864-86	139	1·3
Roumanie, . . .	1875-86	36	1·5
France, ...	1792-1865	571	1·7
Bavière et Palatinat, .	1804-54	337	1·8
Grande-Bretagne, . .	1787-1865	552	1·8

I may mention here that the primary triangulation of South Africa, carried out by Colonel Morris under Sir David Gill, at a date much later than that of the Ordnance Survey, was a very accurate one.

Professor (now Sir George) Darwin, the Astronomer-Royal, Sir David Gill, and other scientific men, consider that the Ordnance Survey triangulation is not accurate enough to combine with that of other countries, where work is more recent, for calculations as to the figure of the earth, and it has been proposed to re-observe with the greatest accuracy possible arcs from the South of England to the Shetland islands, and from Dover to Valentia. Unfortunately this work has not yet been authorised. It seems very desirable that in this matter Great Britain should be able to show as scientifically accurate results as any country.

The calculations for the primary triangulation were carried out by and under Colonel A. R. Clarke, C.B., and were very laborious. In one case it was necessary to solve equations with 77 unknown quantities.

A primary triangulation, although a necessary preliminary to an accurate survey, does not in itself suffice. On the Ordnance Survey, shortly before the detail survey of a district was commenced, a secondary triangulation, with sides of about five to fifteen miles long, was carried out and was based on primary points.

A tertiary triangulation, with sides from half a mile to about two miles long, was in turn based on the secondary triangulation. Thus the whole country was covered with a network of triangles, each point of which was fixed with great accuracy. This proved a framework for the subsequent survey.

Before proceeding to describe the detail survey, I think it well to indicate the general arrangements for carrying on the work.

A number of Divisions, each under an officer and located at convenient centres, not only carry out the field survey but also draw the

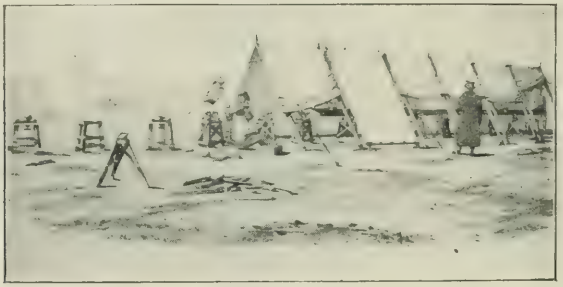


FIG. 4.—Measurement of Lough Foyle Base-line.

fair plans and compute the areas. From these Divisional centres field parties are sent out to survey the allotment of the Division. The officers in charge not only supervise and administer the staff, but also personally check their work.

Two levelling Divisions undertake the levelling and contouring.

There are examination offices at Southampton and Dublin to which the completed plans of Great Britain and Ireland respectively are sent.

There is a large photographic and printing office at Southampton at which, besides the reproduction of Ordnance Survey maps, much work is done for other departments. There is also a printing office at Dublin.

The headquarters of the Ordnance Survey are at Southampton.

I will now briefly describe the detail survey, and some of the checks instituted to assure accuracy.

The detail is surveyed by a chain survey based on the triangulation already described.

So far as I know, no other national survey is carried out by right line chaining, probably because no other country has a general map on so large a scale as the United Kingdom. Chain survey gives excellent results if carried out with suitable checks, but is not suited for topographical work. So excellent has the system of chain survey proved

itself, that, although the Ordnance Survey has always shown itself ready to adopt improved methods, its chain survey is carried out much in the same ways as when first introduced some seventy or eighty years ago.

The most important check on the survey is that the plotting is quite independent of the survey, being carried out in the Division office, usually many miles away, by a separate staff.

The method of working is as follows. A number of surveyors are formed into a party under a superintendent. The latter traces with a theodolite the main lines and one or two split lines of a triangle so as to ensure that these lines are quite straight. He leaves pickets at each wall, hedge, fence, etc., to show where the line cuts them. The surveyor, with the help of a labourer, chains these main and split lines, entering his measurements in a field book. The distances are then sent to the office to be checked.

The trigonometrical points having been accurately scored in the office on plans, the split lines are laid down on these plans. If the surveyed lengths agree within 2 links in 1000 with the correct lengths the lines are passed; if not, they are sent back to the surveyor to be rechained.

Having got his main and split lines correct, the surveyor proceeds to make a chain survey of his triangle, massing lines near detail whose position is fixed by offsets. The measurements are entered in a field-book, which contains also a diagram of the lines net.

The actual chaining requires much skill. The lines must be kept perfectly straight, and the chain must be kept neither too tight nor too loose. The chaining is horizontal, and when chaining up or down a slope the chain, or part of it, is held horizontal, and an arrow is dropped to give the horizontal distance. In mountainous country, however, it was found necessary to resort to surface chaining, and to take the angle of inclination with a theodolite, the horizontal distance being obtained by calculation in the office.

Traverse is only resorted to when lines cannot be chained through so as to tie on other lines. The ingenuity of Ordnance Surveyors in running lines through buildings and other almost impossible places is very great.

The field book, which contains all the surveyors' measurements, is sent in to the office to be plotted. The surveyor is forbidden to plot his own work, nor has he the means of doing so. Hence, even if he wished, he could not fudge his survey.

Lines which do not lay down correctly on the plot are sent back to the surveyor to be rechained.

When the lines of all triangles in a plan have been passed, the field books are handed over to a second line plotter, who lays down the lines on a clean sheet of drawing-paper, on which the fair plan will be drawn. The lines so laid down are compared with those on the original "plot" as a check on the line plotting. The field books are then handed over to a third plotter, who plots the detail on the plan.

It may be mentioned here that the 6-inch and larger scales, and also the 1-inch maps of England and Ireland, are on what is known as the rectangular tangential projection, *i.e.* some central point having been

selected north and south and east and west, a line is drawn through each, and all plan lines are parallel to one or other of these lines.

The 1-inch of Scotland is on a modified equal-area projection known as "Flamstead's Modified."

In the 6-inch and larger scales the original practice was to have the plans of each county on a separate county meridian. Latterly, as many adjoining counties as possible were grouped together on one meridian, the limiting consideration being the amount of divergence of the extreme east and west plan lines.

The plan plotted as above described cannot be accepted as absolutely accurate. Even if the lines are correctly chained certain errors may exist, and if the offsets are not taken exactly at right angles to the chained line some distortion will ensue.

To correct such errors the plotted plan is traced in the office, and the traced plan is sent out to a field party known as an "Examination" party to be checked. Each tracing takes in one-sixth of a full plan, and has wide margins so as to admit, if necessary, of working over the proper limits of the tracing.

"Examination" takes place three or four months after the survey, and is entirely independent of the latter. No man is allowed to "examine" work he has surveyed.

The examiner carefully tests and, if necessary, corrects the detail. He further shows in character woods, orchards, parks, etc., identifies parish and other boundaries from information supplied him, inserts foot-paths, trees where they ought to be shown, and other small details. He ascertains the orthography of names which should appear on the map, and enters them in a name-book with a description of the object, its position, and the names and addresses of the authorities for each name.

The best available authorities are consulted about names and antiquities, and, whenever possible, authority in writing is obtained.

The tracings and name-sheets having been completed by the examiner are handed over to his superintendent, who tests each tracing so as to make sure that the examination has been carefully done. This is known as "final examination." The superintendent also submits the name-sheets and tracings to landowners, agents, etc., and specially investigates names whose spelling is doubtful, makes inquiries as to antiquities, and reports on disputed boundaries. When the work has been completely checked he forwards it to the Division office.

Originally the boundaries were investigated by a special Division of the Ordnance Survey. Meresmen appointed by the Justices of the Peace pointed out the boundaries, and in case of doubt or dispute a very careful investigation was held, and the best documentary and oral evidence available was taken. The boundaries settled on were publicly exhibited, and if questioned the points raised were carefully considered. With the completion of the original survey the need for a special boundary Division disappeared. Each Division now does its own work.

For many years past the plans have been drawn for reproduction by photography in some form. The process used at present for the larger scales

is known as the Vandyke process—from its inventor, Conductor Vandyke. This requires the outline to be drawn firm, even, and absolutely black. The paper must be kept quite clean—a very difficult matter considering the amount of work on each plan.

The drawing is made as follows:—An examination tracing is laid in position on the plotted plan, and alterations are transferred to the latter by the help of carbon paper. The outline is then penned in. Instead of writing names and numbers these are typed. This secures uniformity and economy. Trees, woods, orchards, marshes, etc., are stamped in conventional character. Such stamping is better and much quicker than hand work. The detail, names, boundaries, etc., on the plan are carefully compared with the examination tracings and documents, and doubtful points are referred to the Superintendent who carried out the final examination in the field, and, if necessary, revisits the ground before reporting.

When all doubtful points have been settled the Division officer takes a batch of plans to the field and personally checks a portion of each.

The plans are then sent to the Computing Department. Each parcel which is large enough is first given a reference number, each parish being a separate series of numbers.

Separate and independent computations are made by two different persons, and their computations are compared by the Superintendent or other responsible employé. If the computations do not agree within a certain limit, a third computation is made. Computations obviously in error are rejected, and the mean of the two remaining computations is taken.

The areas are computed by scale, and as each $\frac{1}{2500}$ scale plan contains 960 acres, the sum of the areas on each plan must close to that area.

The computations are compiled in an area book and closed accordingly.

After computation the plans are sent to a levelling Division, which should have already carried out the requisite levelling, and the bench marks and surface levels are plotted and typed.

The plans are then sent to Southampton or Dublin for examination of detail and areas. A third and independent computation of areas is made as a check on that made in the Division. Errors or doubtful points are referred back to the Division for consideration.

When all points have been settled, the areas are stamped on the plans, which are then sent to Southampton or Dublin with a view to publication.

I have detailed, at a length which I fear may be considered wearisome, some of the principal checks in force on the Ordnance Survey, because I wish to show that no labour is spared to make the work accurate. I would only add that when, in spite of all care, mistakes such as printers' errors creep in, the Ordnance Survey is grateful to those who point them out.

It is not possible, without making this paper unduly long, to enter into the details of reproduction. There have been many changes in methods of late years. I would only say that as much care has been taken with

the cartography as in the survey, and that no efforts have been spared to issue the maps in the best possible manner and in the forms likely to be most useful to the public. I may say briefly that engraving on copper is still used for small-scale maps. Heliozincography has superseded photozincography for the 6-inch scale and certain other maps; for the 25-inch and many other purposes the Vandyke process has superseded zincography, photozincography, and heliozincography. Photo etching has been introduced for some small scale work. Coloured printing is increasingly resorted to.

I need not here detail the series of maps published by the Ordnance Survey. The number of maps is very large. There are, roughly speaking, about 97,500 different maps and indexes, and when the 25-inch map of Ireland is completed, the number will be nearly 110,000. Of each of these maps impressions varying from 20 to 1000 or more are printed.

A list would show that while a large part of the Ordnance Survey Staff is necessarily employed on large scale work, topographical maps are not neglected. Up to 1826 the Ordnance Survey was a purely topographical one, and although for a good many years the necessity for completing the large scale survey entailed a postponement of topographical work, maps of the latter class were proceeded with as soon as it was possible to do so. I have always admired the foresight and judgment exercised by the early heads of the Ordnance Survey in laying down an accurate and scientific basis for the Survey, which has answered for the large scale work subsequently decided on as well as for the topographical maps originally designed.

In this respect, thanks largely to the foresight of Sir David Gill, Astronomer-Royal at Cape Town, South Africa is fortunate in having a highly accurate primary triangulation. I believe a secondary triangulation is now in progress.

A good foundation having thus been laid, it remains to build on it the superstructure. Unfortunately financial reasons have, for the time at any rate, stopped the proposed topographical survey of South Africa. It is to be hoped that it is only postponed.

An expensive survey on large scales such as has been carried out by the Ordnance Survey is clearly out of the question at present in South Africa, except for very limited areas; but a topographical survey is comparatively inexpensive, and is as necessary in a partly developed country like South Africa as in a settled country. The South African War gave an object-lesson in the disadvantages of defective maps, and good maps are as necessary in peace as in war. There are hardly any administrative or political questions which can be satisfactorily settled without good maps, and many a political dispute and even war has originated in agreements based on defective maps. Topographical maps are wanted for engineering purposes, such as the preliminary laying out of railroads, roads, canals, etc., and for many business purposes, while they are of the utmost military value even in peace time for training and manœuvre purposes and for military problems connected with the defence of the country, and with the connected military operations.

Not only is a topographical survey comparatively inexpensive, but,

provided it is based on proper triangulation, even a small expenditure on it would enable useful work to be done.

I cannot believe that the South African Colonies will long be content to be without good maps, and I am sure that any colony which has once experienced the advantages of a good topographical map will find the means to complete its survey within a reasonable time.

GEOGRAPHICAL NOTES ON SOUTH AFRICA SOUTH OF THE LIMPOPO.

By F. S. Watermeyer, Government Land Surveyor.

(*Continued from page* 636, vol. xxi.)

Undoubtedly the best-watered part of South Africa is along the eastern slopes of the Drakenberg, extending south from the Zoutpansberg along the Spelonken, the Woodbus mountains, the Wolkberg, the Drakenberg proper, up to the borders of the Transkei and Basutoland. The Lebombo mountains running nearer the coast, and extending through the Portuguese territory, Swaziland and Zululand, and the lower coast ranges in Natal, Pondoland, and the Transkei, also contribute to condense the clouds from the east into rain over those parts.

The Portuguese territory along the east coast is very well watered, rich in grasses, which form excellent pasturage which feed cattle, Kaffir sheep (of the Persian class), and goats. All kinds of semi-tropical fruits can be grown; the staple cereals produced are maize, Kaffir corn, and rice, besides the different kinds of Kaffir beans, ground nuts, etc. etc.

Along the slopes of the Drakenberg, at a height of about 3000 feet, coffee, tobacco, and citrous fruits, as well as bananas, pines, etc., grow luxuriously in the rich red and black loam and gravelly soils overlying the mountain slopes and valleys. This belt extends south through the districts of Lydenburg and Barberton, and through Swaziland into Natal, and thence along the south coast as far as the Port St. John's River. Further south semi-tropical plants and fruits grow less luxuriantly as the latitude increases southwards. The best wheat-producing parts of South Africa, viz. those where wheat is grown without the aid of irrigation, are undoubtedly on the west coast of the Cape Colony, from the Elephant's River as far as Swellendam, Robertson, Riversdale, and Mossel Bay, and a strip of land along the western slopes of the Drakenberg in the Orange River Colony known as the "conquered territory," where the rainfall during the months of April, May, and June is sufficient to cultivate that grain. Maize and Kaffir corn can be grown readily throughout Bechuanaland, the Transvaal, the Orange River Colony, Natal, and the eastern coast districts of the Cape Colony, without irrigation during the summer months. Barley, oats, and rye grow best without irrigation, and some kinds of oats can be grown during the rainy season when sown in January and February. Potatoes and yams (sweet potatoes) thrive well, the former when planted and

watered early in the spring, or when watered by the rain in the autumn.

In the northern and north-eastern parts of the Transvaal, coffee, cotton, and tobacco thrive. Hitherto only the indigenous wild cotton has been grown, but a commencement is being made by the Transvaal Consolidated Land and Investment Company and others in the planting of good classes of cotton for export purposes.

In considering the question of grain and other crops that can be grown, I must again revert to the formation.

I have described the different tablelands already. The first drop round these tablelands to the east, north, and north-west is called the Middle or Bush Veld, at a height varying from 2000 to 3500 feet, and even more in some cases.

This country is generally covered with scrub growth of indigenous trees, and by studying the class of trees, the nature of the soil, whether rocky, poor and gritty, sandy or rich loam, can be at once seen. The growth of the common mimosa or sweet thorn points to the richest alluvial loams. The mimosa sometimes grows in the cold High Veld, generally along the banks of the streams, or in valleys, and always marks the existence of loam deposits. Different kinds of protea, including the beautiful silver tree, which only grows about the hills in the Cape Peninsula, grow on most of the rocky elevations throughout South Africa. The South African willows and Karree-hout, like the mimosa, are found where the soil is deep and good. The different classes of "Wacht-en-beetje" and Haak-Doorn (also mimosa), the African beech, leadwood, Vaal-Bosch, and seringa, grow extensively where the deposits are deep and of a sandy nature. The iron-wood, Stam Vruchte, and wild medlar, like the protea, generally grow on the hills or on rocky, gritty slopes. In the low country north of the Olifant's river, the Mapani tree, rich in turpentine, grows over large areas. The gigantic Baobab tree is also found scattered over the low country. This part of the country is well watered by thunderstorms during the fever season, but otherwise is very dry.

Maize, Kaffir corn, manna, potatoes, beans, peas, and ground-nuts, can be grown throughout South Africa by irrigation, and as summer crops wherever the summer rains extend; semi-tropical fruits on the Low and Middle Veld, and along the eastern slopes of the Drakenberg southwards; peaches at all altitudes to 2000 feet or over; plums, pears, apples, etc., especially on the High Veld.

The Agricultural Department is doing yeoman service in proving the capabilities of the country for agriculture and stock-farming.

The different kinds of antelopes, sable, roan, koodoo, waterbuck, gnu, impale, isesibi, with the Burchell zebra, are still found, and it is hoped that their numbers will increase, as they are now protected by the Game Laws.

The zone of the maximum rainfall along the eastern and southern slopes of the Drakenberg and the coast ranges on the south as far as Swellendam, is marked by belts of forests known as "Woodbushes," where different kinds of indigenous timber trees grow.

In many parts of the Cape Colony, Natal, Transvaal, and Orange River Colony, the black wattles, eucalypta, etc., have been extensively planted, and thrive well, especially on the eastern slopes and on the High Veld, and with enterprise these trees can be grown all over the country, where summer thunderstorms are regular.

Before diseases and war devastated the country, South Africa was rich in cattle, and before many years are over, when diseases are stamped out, it is likely that they will again be plentiful.

Horses, sheep, and goats thrive well in the High Veld, but not in the low or middle velds, where they are carried off by disease. Asses are found, and breed well everywhere in South Africa. The Merino and Angora goats, especially in the Karoo and the Cape Colony, thrive well; and mohair and wool will shortly again be a staple export, as well as cotton and tobacco.

Sufficient fruit can be grown to allow of dried and canned fruits being exported in time.

4. Climate.

The climate of South Africa varies as we proceed from the Cape northwards. During the summer season the heat in the south of the Cape Colony, in spite of the latitude, is oppressive, except where it is mitigated by winds from the coast.

To the north the altitude in the high plateaux tends to lower the temperature considerably. Still more to the north in the Middle Veld and low country and on the east coast, the thermometer frequently reaches 115-120 degrees in the shade. The climate of the Southern Transvaal, Bechuanaland, and Natal are throughout healthy for human beings. In the northern low country and along the low-lying east coast through Swaziland, malarial fever abounds, and white people are more subject to its attacks than the Kaffirs who live in those parts. Still numbers of the latter contract the disease annually, and many succumb to it.

From November to April the rains in the north and east keep the air moist and salubrious, although the temperature is often very high. In the winter months the air is dry, cold, and healthy.

In June in the Bush Veld I have registered 12 to 22 degrees (Fahrenheit) of frost from 2 to 6 A.M., and the same day the thermometer rose to 90 degrees by noon. This shows a difference of temperature of 80 degrees in twelve hours.

The variation of the temperature on account of the radiation of heat during the night in the clear dry atmosphere of South Africa, and the heat of the sun during the day when the air is undisturbed, causes these extremes.

About the Equinox in September, strong winds either from the south-east or north-west sweep over the country. These gales generally last intermittently from August to October annually, and are the precursors of the rains.

A table of latitude, longitude, height, and annual rainfall, is attached. (See Appendix B, p. 36.)

APPENDIX A.

History of Population, etc., of Cape Colony.

From the commencement of the colonisation of the settlement of the Cape of Good Hope, it was the practice to have annual enumerations of the population, live-stock, and agricultural produce, for the purpose of communicating the ascertained results to the Directors of the Netherlands East India Company.

Governor van Riebeek took possession of the Cape on behalf of that Company on 9th April 1652, but the earliest report to which reference has been made relates to the year 1687; from which date, with a few casual exceptions, these annual returns run down to 1875. The statements for the period 1713 to 1743 are, however, imperfect.

At the end of 1690 the population of the colony, then bounded by the Drakenstein Mountains, consisted of 836 burghers including their families, and 381 slaves. The strength of the Company's staff was 489 in 1691; no return is available for 1690. The yield of the crops was 4544 muids of wheat, 939 of rye, and 377 of barley; while the vines numbered 486,550, the cattle 3966, horses 220, and sheep 44,741. It is interesting to observe that Cape wine was sent to the Company's directors in Holland during this year. Wool was exported for the first time in 1700.

From the report for 1705 it will be found that, besides the garrison of 542 souls, the burgher population had increased to 1169 (706 being females), and the coloured section to 1123 persons. Vine-stocks were reckoned at 1,912,050, and 1132 leaguers of wine were made.

From 1713 to 1743 the available statistics of population are imperfect—information being merely given regarding revenue, expenditure, and the strength of the Company's staff.

The enumeration for 1744 showed, in addition to a garrison of 1089, a burgher population of 4060 and a coloured one of 5127 persons. The harvest being exceptionally good, the wheat crop yielded 27,438 muids. The vintage gave 2070 leaguers of wine from 3,033,500 vine-stocks; and the colonists had then 34,789 cattle, 6404 horses, and 162,305 sheep.

In case the reader wishes to contrast the census figures for 1865 with those for 1765, the older results are presented below, thus :—

Population,	Garrison and Company's staff,	1,489
,,	Burghers and families (3216 being females),	7,141
,,	Others,	7,929
	Total,	16,559

Crops—Wheat, 8653 muids. Rye, 411. Barley, 2222. (Season very poor.)
Live-stock—Cattle, 36,188. Horses, 6422. Sheep, 204,429.
Vintage—2786 leaguers of wine. Vine-stocks, 5,071,000.

Ten years later the population was as follows :—

Garrison and staff,	2,019
Burghers and families,	8,977
Others,	9,642
Total,	20,638

The report for 1791 is missing, but it has been ascertained from Theals' *History* that the European population of the colony then consisted of: 3013 burghers, 2460 women, 6955 children, 495 men and 1051 women servants. With the assistance of the keeper of the archives, I have endeavoured to ascertain figures for the year 1804 in reference to the population, revenue, produce, etc., of the Cape, but, owing no doubt to the dislocation of government, due to the changes of administration between the British and the Dutch, the necessary returns cannot be traced.

In 1803, however, when the colony was restored to the Dutch, the population was stated to be—Europeans, 24,778 (males, 6890; females, 4761; and children, 13,127). Servants, 482; baptized Hottentots, 30; slaves, 35,849 (males, 20,960; females, 9169; children, 5720); and unbaptized Hottentots, 7375, giving a total of 68,514 persons.

The live-stock in the colony in 1803 was computed at 49,778 horses, 225,635 cattle, and 1,490,880 sheep.

In 1805 the population is given as—Europeans (*i.e.* excluding soldiers), 25,757; slaves, 29,545; indentured Hottentots, half-breeds, and bushmen, 20,006; or a total of 75,308.

Cape Town in 1805 consisted of 1258 houses and stores, with a population of 16,984 persons, viz.: 6275 Europeans, 1130 Asiatics and free blacks, 9129 slaves and 452 Hottentots.

In the report on the census of 1875, reference is made to the yearly returns of the population published in the Annual Blue-Books of the Colony from 1823 to 1856. These returns formed part of the statistical information on a variety of subjects, such as area and population of divisions, live-stock, agricultural and animal produce, etc., which was sent in annually to the Colonial Office by the various Civil Commissioners. The returns were discontinued after 1856, owing to the expense involved in the collection of the information and to the doubts entertained as to its accuracy when collected. Indeed, as was pointed out in the report above-mentioned, it is not easy to reconcile the figures for 1856 with a population of 496,381 returned at the census of 1875.

The approximate returns of population given in the Annual Blue-Books for the years 1823 to 1849 are as follows:—

1823,	112,870	1832,	No record	1841,	155,324
1824,	121,689	1833,	124,455	1842,	171,724
1825,	118,125	1834,	153,328	1843,	172,868
1826,	121,497	1835,	154,250	1844,	179,709
1827,	127,689	1836,	152,240	1845,	178,480
1828,	119,709	1837,	142,865	1846,	180,594
1829,	118,717	1838,	153,887	1847,	180,186
1830,	124,789	1839,	149,719	1848,	185,211
1831,	126,848	1840,	156,088	1849,	285,279

The year 1904 marked the fiftieth anniversary of the establishment of representative government in the colony, the first Parliament having been opened by Lieutenant-Governor Darling on the 30th June 1854. It would, doubtless, be of interest to trace in some detail the development of the colony during these fifty years; but I am able in the present report to make only a few general observations recapitulating comparative figures under a few of the chief heads in tabular form for the sake of convenience.

The Legislative Council, elected in January 1854, consisted of 15 members as

compared with 26 to-day, and the House of Assembly, which was elected in the following April, of 46 members against the present total of 107.

The colonial revenue has risen from £295,802 to £8,746,528, and the expenditure from £312,521 to £10,062,681. The area of the colony has grown from 118,256 square miles to 267,995 square miles; and the population from, approximately, 109,921 white and 138,704 coloured British subjects, and 11,866 aliens—making a total of 260,491 persons to 2,409,804. The number of inhabitants to the square mile has thus advanced from 2·20 to 8·70.

In 1854 the total value of imports (including £17,589 specie) was £1,565,626; in 1904, £21,863,340 (including £39,031 specie); and of exports in 1854 (including £53,301 specie), £817,762, and in 1904 £27,406,672 (including £837,790 specie).

The value of colonial produce exported in 1854 amounted to £662,936 as compared with £5,100,684 in 1904, exclusive of diamonds, which were valued at a further £5,333,851.

The ports of the colony in 1854 numbered four, viz.—in order of importance, Cape Town, Port Elizabeth, Simonstown, East London. The number of ships which entered at these was 610, 148, 39, and 29 respectively—giving a total of 826, with a gross tonnage of 240,543; of this total 704 were British vessels. To-day the colony boasts of eleven ports and harbours, and shows a record of shipping entered during 1904 of 2778 vessels, having a gross tonnage of 11,057,914. The total number of British vessels entered inwards was 2221.

As regards education, there were 130 schools in 1854, with 13,961 scholars on the rolls, and an average attendance of 9730. The census returns for 1904 give 3492 schools, 164,855 scholars, and an average attendance of 147,039.

Turning to the local government, in 1854 there were only 24 municipalities as compared with 114 and 77 village management boards to-day. The returns of revenue and expenditure for three of these are wanting for 1854, but the remainder show a total of £22,112 receipts and £23,952 expenditure. Cape Town, according to a census taken by De Lima in 1854, consisted of 3891 houses and stores, with 25,189 inhabitants; and its revenue and expenditure were £9510 and £11,438 respectively. In 1904 it shows 13,245 buildings, 77,668 inhabitants, and in the preceding year its receipts were £1,255,342, and its payments £1,178,607. The gross receipts and expenditure of 102 municipalities for the year preceding 1904 were £2,097,240 and £2,028,055 respectively. In addition, there were in 1904 75 divisional councils, with a revenue in 1903 of £210,355, and expenditure amounting to £236,524.

Appended is a comparative table for the years 1854 to 1904:—

	Cape Colony.	1854.	1904.
Area and Population, .	Area in square miles,	118,256	276,995
	Population, . . .	259,639	2,409,804
	Persons to square mile, .	2·20	8·70
Finance, . . .	Revenue, ...	£295,802	£8,746,528
	Expenditure, . .	£312,521	£10,062,681
Trade, . . .	Exports—Total, . .	£817,762	£27,406,672
	Exports—Colonial produce,	£662,936	£10,434,535
	Imports—Total, . .	£1,565,626	£21,863,340
Shipping, . . .	Ports and harbours, .	4	11
	Vessels inwards, . .	826	2,778
	Tonnage of vessels inwards,	240,543	11,057,914

	Cape Colony.	1854.	1904.
Municipal Affairs,	Municipalities,	24	114
	Revenue,[1]	£22,112	£2,097,240[2]
	Expenditure,[1]	£23,952	£2,028,055[2]
Education,	Schools,	130	3,492
	Scholars,	13,961	164,855
	Average attendance,	9,730	147,039

The total returns of stock for the Cape Colony by the last census are as follows :—

60,907 bulls.
540,310 milch cows.
533,982 oxen.
819,191 other cattle.

1,954,390 total cattle.

8,210 stud stallions.
45,270 brood mares.
201,560 other horses.
64,433 mules.
100,470 asses.

419,943 total horses, mules, and asses.

8,465,308 woolled sheep
3,353,521 other sheep.
2,775,927 Angora goats.
4,386,536 other goats.
357,970 ostriches.
389,918 dogs.
385,945 pigs.

The census return of each colony for 1904 shows the population of the various towns in South Africa.

The seaports, Cape Town, Port Elizabeth, East London, Durban, and Lorenço Marques, do all the seaport trade with the interior.

Kimberley, C.C., Jagersfontein, O.R.C., and the Premier Mines, Transvaal, are the centres of diamond mining.

Johannesburg, Barberton, Lydenburg, and Klerksdorp are the gold-mining centres.

Boksburg, Vereeniging, Belfast, and the surrounding districts, are the centres of the coal mines.

The other chief towns are merely mercantile centres depending for their trade upon the surrounding districts.

The seven principal railway systems are :

From Pretoria, *via* Orange River Colony, to East London.
From Pretoria, *via* Orange River Colony, to Port Elizabeth.
From Pretoria, *via* Orange River Colony, to De Aar and Cape Town.

[1] Partial only for both years. [2] For the year 1903.

From Pretoria, *via* Orange River Colony, De Aar, Kimberley to Mafeking and the North.
From Pretoria to Lorenço Marques.
From Pretoria to Durban.
From Pretoria to Pietersburg.

APPENDIX B

The following tables give the position on the map, the height above sea-level, and annual rainfall, of most of the South African towns and some meteorological stations :—

	Latitude. S.	Longitude. E.	Height. Feet.	Annual rainfall. Inches.
Port Nolloth	29 14	16 51	40	2·45
Springbokfontein	29 40	17 53	3200	9·74
Clan William	32 10	18 53	245	9·41
Piquetberg	32 53	18 45	700	22·36
Malmesbury	33 28	18 43	460	18·46
Claremont	33 59	18 28	91	35·36
Calvinia	31 29	19 46	3100	8·69
Ceres	33 23	19 20	1493	41·65
Caledon	34 14	19 27	760	24·74
Brandvley	30 25	20 30		5·37
Matjesfontein	33 14	20 40	2600	6·43
Sutherland	32 25	20 42	4776	10·00
Van Wyk's Vlei	30 24	21 49	3300	7·44
Riversdale	34 8	21 22	100	19·47
Beaufort West	32 21	22 37	2850	9·74
Oudtshorn	33 36	22 13	1090	10·42
Hanover	31 3	24 36	4500	16·66
Middelberg	31 33	24 58	4000	17·67
Graaf Reinet	32 16	24 32	2500	18·26
Humansdorp	34 2	24 47	360	27·21
Boshof, O.R.C.	28 32	25 21	4100	21·96
Jacobsdal	29 5	24 55	3200	19·76
Philippolis	30 13	25 18	4700	21·73
Colesberg, C.C.	30 43	25 5	4400	18·21
Naauwpoort, C.C.	31 15	25 10	4884	16·96
Cradock	32 11	25 38	2856	17·21
Port Elizabeth	33 58	25 37	181	20·66
Bloemfontein, O.R.C.	29 7	26 15	4518	25·39
Molteno, C.C.	31 24	26 21	5181	27·69
Tarkastad	32 00	26 15	4300	22·68
Bedford	32 41	26 6	2450	30·35
Lovedale	32 46	26 51	1720	27·27
Kroonstad, O.R.C.	27 29	27 44	4500	27·17
Maseru (Basutoland)	29 15	27 47	5000	34·4
Lady Grey	30 43	27 12	5000	36·67
Barkly East	31 2	27 35	5830	28·31
Dordrecht	31 22	27 4	5500	27·82

	Latitude. S.	Longitude. E.	Height. Feet.	Annual rainfall. Inches.
Cala	31 30	27 40	5500	27·28
Cathcart	32 15	27 10	3900	29·94
Stutterheim	32 34	27 26	2740	32·55
King William's Town	32 42	27 23	1314	27·47
Peddie	33 13	27 7	500	27·38
Mount Fletcher	30 42	28 30	5500	35·20
Matatiele	30 15	28 46	4900	35·21
Maclear	31 4	28 21	4000	45·73
Butterworth	32 21	28 8	1990	30·36
Harrismith	28 20	29 11	5200	29·14
Kokstad	30 33	29 26	4284	21·76
Port St. John's	31 38	29 35	22	46·51
Umzimkulu	30 15	30 20	2000	28·40
Durban	29 51	31 00	260	42·46

TRANSVAAL.

1st July 1903—30th June 1904.

	Latitude. S.	Longitude. E.	Height. Feet.	Months.	Annual.	Rainy days.
Barberton	25 50	31 4	2200	9	27·15	83
Komati Poort	25 26	31 54	620	6	27·41	51
Bloemhof	27 38	25 37	4100	7	11·67	36
Bethal	26 27	29 28	5200	9	28·54	79
Christiana	27 54	25 9	4050	4	10·33	15
Schweizer Renneke	27 3	25 22	3900	5	14·07	32
Carolina	26 2	30 6	5000	5	9·80	25
Machadodorp	25 41	30 14			34·01	89
Lake Chrissie	26 15	30 12	5200	8	27·31	65
Ermelo	26 31	29 58	5150	7	16·07	65
Amsterdam	26 36	30 39	4100	6	18·31	46
Heidelberg	26 30	28 22	5020	10	24·98	87
Vereeniging	26 39	27 55	4770	12	23·37	94
Lichtenburg	26 9	26 9	4300	9	25·71	68
Sabi	25 3	30 47	3900	12	53·61	117
Lydenburg	25 6	30 27	4100	5	12·76	29
Belfast	25 42	30 3	6450 (?)	6	10·54	56
Pilgrim's Rest	24 54	30 45	4100	9	33·16	19
Ottoshoop	25 48	25 58	4250	5	11·20	22
Zeerust	25 32	26 5	3700	9	26·86	79
Middelburg	25 43	29 28	4970	9	26·54	84
Piet Retief	27 00	30 49	4000	6	12·53	31
Potchefstroom	26 42	27 8	4450	7	21·47	64
Klerksdorp	26 51	26 39	4350	12	20·76	76
Pretoria	25 39	28 14	3690	8	32·29	78
Standerton	26 55	29 14	5020			
Mabaan (Swaziland)	26 20	31 2	4050	12	46·40	110
Pig's Peak	25 56	31 11	3800	11	54·23	125
Wakkerstroom	27 21	30 10	5500			

	Latitude. S. ° ′	Longitude. E. ° ′	Height. Feet.	Months.	Annual.	Rainy days.
Volksrust	27 22	29 53	5430	9	33·62	99
Warmbad	24 40	28 21	3350	6	13·77	11
Nylstroom	24 42	28 20	3600	9	30·37	71
Reitfontein	24 39	28 16	3600	12	29·31	65
Geelhoutkop	24 28	28 28	3460	12		
Potgeitersrust	24 8	29 3	5600	9		74
Krugersdorp	26 7	27 45	5710	18	32·00	87
Johannesburg	26 11	28 3	5750	12	34·98	96
Germiston	26 12	28 11	5480	7	26·06	66
Boksburg	26 15	28 15	5350	12	32·59	77
Wolmaranstad	27 12	25 59	4500	9	20·7	70
Pietersburg	23 44	29 48		8	37·00	66
Spelonken	23 2	30 7	3960	5	47·9	51
Sutherland Reef	23 59	30 26	2050	7	15·88	56
Krabbe Fontein	23 51	29 57	about 3000	8	74·64	107
Elim	23 9	30 00	3900	9	54·46	70

THE AMUNDSEN EXPEDITION TO THE MAGNETIC POLE.

As briefly announced in our last issue, long dispatches from this expedition have been received, and have appeared in full in the *Times*. The letters were carried from King William's Land by Eskimo to Fullerton, Hudson Bay, and were delivered to Major Moodie, and were then forwarded to Quebec. As the dispatches give a concise account of the work of the expedition, we publish them in full here.

GJÖA HARBOUR, KING WILLIAM'S LAND, *November* 24, 1904.

On July 31, 1903, we left Godhavn. Reached the ice at Melville Bay, August 8, near "Devil's Thumb." Escaped—after some search—out into the "North Water" on the 14th. On the 16th and 17th brought on board the stores, deposited by the Captains Milne and Adams on Dalrymple Island. Set off at once westward. Arrived on the 22nd at Beechey without having been hindered by ice. Here the magnetical observations, decisive for the rest of our voyage, were made. These pointed to the pole as being in southerly direction. Sailed on the 24th southwards with course for Peel Sound. Had bearings in Peel Sound on the 26th. Thick fog from the very beginning of Lancaster Sound. The compass available as far as Prescotte Island (Peel Sound). Here it failed. Thick fog, calm, and without compass, the navigation becomes somewhat uncertain. However, we advanced. Escaped the struggle with the impenetrable ice, and passed through the Bellot Straits on the 28th. Stole down along the west coast of Boothia through a good opening along the land. Struck the ground on September 2, between Matty and Boothia. Had to throw the deck cargo overboard and sailed off under a storm on the 3rd, losing the false keel. Found the Simpson Straits ice-free. On the 9th anchored under King William's Land, and came on the 12th into our winter harbour—Gjöa Harbour (Pettersen's Bay, M'Clintock). A better harbour we could not have found. Quite small, and closed everywhere.

On the 17th the provisions were landed by the means of a suspension track and deposited in a house erected for that purpose. In the course of October the house

of magnetic variations was built, the meteorological institute with dwelling for two of the party, astronomical observatory, house for the absolute magnetical observations, house for the observations of the inclinations, house for the keeping of the magnetical instruments. The two former are built of cases and very strong. The others are built of snow and sail-cloth. On November 2 all the observations were commenced, and they have been continued without interruption ever since.

On October 29, 1903, we had the first visit by Eskimo—Ogluli-Eskimo, from the North Coast of America. Later we have met with Netchilli-Eskimo, from the west coast of Boothia, and Itchuachtorvik-Eskimo, from the east coast of Boothia. Slayed in the course of October 100 reindeer. The winter passed satisfactorily; however, we lost seven of our best dogs. They got the cramp, their hind legs were paralysed, and they died after a couple of days. February turned out the coldest month, with an average temperature of $-40{\cdot}5^{\circ}$ C. Commenced on March 1, 1904, putting down the stores for the coming spring voyage to the vicinity of the pole. Observed during this tour—in the interior of the country—our lowest temperature $-61{\cdot}7^{\circ}$ C. The travel by sledge to the polar region itself was commenced by Ristvedt and myself on April 3 with two sledges and ten dogs, several of which were whelps. I dare not say anything about the result of this tour. Had five stations in all along the west coast of Boothia up to the Tasmania Islands. Had to return earlier than originally intended, the Itchuachtorvik-Eskimo having plundered our depôt. Came back at the end of May. The summer I have spent in magnetical observations around the station. The ice went at the beginning of August, came in October 1903, and several times was out of sight. The summer was cold and rainy—according to the Eskimo the worst summer they ever had. Lieutenant Hansen and Helmer Hansen, on the breaking up of the ice, 1904, went westward through the Simpson Strait in a boat. The object was to explore the narrowest part of the strait about Eta Island, and to put down stores for the intended sledge travel to the west coast of Victoria Land in the spring of 1905. They met with much ice on their westward voyage, but it was accessible for a vessel of the size of the *Gjöa*. The sea was rather shallow. We now have commenced our second winter here. We are all in good health, and everything is in the best order. Wiik has put up the variation instruments—October 1903—and has attended to them the whole time. Ristvedt is the meteorologist. Lieutenant Hansen has to take care of the astronomical observations. Lund and Hansen have their hands full on board. Lindström is indefatigable in his work. As for myself, I make the daily absolute magnetical observations. The variation instruments will be kept in function till June 1, 1905. At that time we will commence taking on board everything, in order to be ready for departure from here in the middle of July.

All of us have tried to do our best to make as much as possible out of our stay here. Besides the variation instruments, which have been in continual function, we also have made daily absolute observations. Along with the meteorological observations, we have also made observations of the aurora borealis. Besides, we have ample collections of ornithological, ethnographical, and botanical matter, and some fossils.

It is my intention to make my way out of the ice and go direct to San Francisco in the autumn of 1905. If the chances, as far as the ice is concerned, be favourable I think we shall manage it. I will not omit to mention that the variation on the spot varies between N. 10 W. and N. 10 E. We have even found greater deviations. Most frequently it is about 5 W. The inclination is about 89° 20′.

We have just, during these days, had a visit from a Kinepatu-Eskimo, resident

on the Chesterfield Inlet, Hudson Bay. He reports that there are two fishing vessels near Katiktali (Winchester Inlet).

I send a Netchilli-Eskimo by the name of Talurnakto, together with the Eskimo mentioned before, down there to deliver post from us.

GJÖA, KING WILLIAM'S LAND, *May* 22, 1905.

Since my last letter—November 1904—I have nothing of special interest to report. The Eskimo whom I sent southwards with the post in November 1904, found *Arctic*, formerly *Gauss*, at Cape Fullerton, in the Hudson Bay. Major Moodie, of the Royal North-West Mounted Police, who is acting commander of this ship, has written me that the post will be in Ottawa about August 10, and will be re-forwarded from that place. As the Eskimo, who is a native of Cape Fullerton, is to go south again, I send this letter by him. This winter has not by far been so hard as the former. The sea-ice, which last year about this time measured about 380 cm., now is no more than about 170 cm. The lowest temperature we had in February – 45°. A great number of Netchilli-Eskimo stayed here during the darkest part of the winter. The spring made signs of its coming as early as the end of March. The temperature now already has been above zero several times. The health has been excellent all the time. I commenced in February to circle the magnetic station, and have just finished this task. Lieutenant Hansen and Sergeant Ristvedt left here on April 2 to draw a map of the east coast of Victoria Land. They were equipped for seventy days—two sledges with six dogs at each. Fresh meat we have had the whole time—reindeer and salmon.

The magnetic variation house has been in uninterrupted activity. Wiik has managed this work, and done it excellently. On the whole, I must add that all and each of the party have done their duty to the utmost. Absolute magnetic observations have been made daily, and at all temperatures. The meteorological registering instruments have been in function all the time. The zoological and ethnographical collections are constantly increasing. The magnetic variation house will be pulled down in the beginning of June after nineteen months of uninterrupted activity. As regards the results I cannot say anything.

From Captain Bernier, master of the *Arctic*, and from Captain Comer, who is at the same place with the whaler *Era*, I have received the information that the American whalers on the West Coast of America enter on the north side of America as far as Cape Bathurst, 70° 35′ L.N., 127° 30′ L.W. of Gr., and sometimes winter at the Baily Islands, located close to the said cape. Should anything happen to the expedition on its way thither I will at any costs try to save the magnetic results and bring them there. If we should not come out this autumn I would request you kindly to let this be made known in San Francisco, as in that case we should be sure of receiving assistance by the whalers of that place.

Still later news, under date December 5, comes from Fort Egbert, Eagle City, Alaska, from which settlement a cablegram has been received from Captain Amundsen himself in which he says:—

The *Gjöa* is wintering at King Point, 69° 10′ N. lat. 137° 45′ long. West of Greenwich. All well. On August 13 we left the *Gjöa*. The harbour itself was free from ice. All was ready on July 28, but the narrows between Todd Island and Point Richardson were packed with ice, so we had to retard our departure

until the dark nights were setting in. Even on the day of our passage we had to pass a lane between the ice and Todd Island just as broad as the ship herself. This passage accomplished, we came into open water. On the 14th we stopped at Kaminglu, a few miles east of the narrowest part of the Simpson Strait. . . .

Having got supplies of deer meat on board, we proceeded, and passed the same day through the narrows of the strait, three-fourths of a kilometre broad, south of Eta, the passage north of this island having proved impossible on a boat journey led by Lieutenant Hansen in the summer of 1904. The bottom, which along the shore of King William Land is very level, becomes more rough near the shore of America. The depth decreased towards the narrows, our smallest sounding being three fathoms. Proceeding westward we had on the 15th to pass a large group of islands surveyed by Lieutenant Hansen and Sergeant Ristvedt on their sledge journey in the spring of this year. The group consists of more than a hundred islands and islets crowded in the sea between King William Land and Victoria Land, from 69° 10′ N. lat. to 68° 30′ and W. long. 99° 30′. The intersecting channels are shallow and full of shoals. We had to make our way through some of these, trusting to the lead, as the pack filled the sea south of the islands.

In the evening we reached Victoria Strait, where we had to cross a large body of ice. In the morning of the 16th we reached clear water and entered the strait between America and Victoria Land south of Lind Island. On the 17th we anchored under Cape Colborn, outside Cambridge Bay. Collinson was here in 1852-3. We proceeded on the 18th in the traces of Collinson, the sea being clear of ice. On the 20th we had to drop our anchor under Douglas Island. We had passed half a day in a vain attempt to find a passage between the shallows connecting Lambert Island and Douglas Island with the mainland of America, but the wind freshening from the east grew too strong to permit our sounding forward in safety. On the 21st we succeeded in finding a passage with not less than seven fathoms close to the shore of the mainland. Having passed Lambert Island we found the Dolphin and Union Strait likewise free of ice. The weather, which up to this time had been very favourable, grew more rough, with westerly winds. We passed near Clerk Island without seeing it. . . . We proceeded towards Cape Bathurst, and on the 30th we passed this point, having been retarded by ice packed on the land east of Cape Bathurst. On the 31st we were forced by ice to turn to the south towards the shallows of the mouth of M'Kenzie River. On September 1 we sighted Hooper Island. . . . On the 2nd we reached Cape Sabine.

We proceeded the next day, but were stopped at King Point, the ice lying on the shore. We moored to a floe just outside a grounded schooner. As the ice did not move off the shore soon and the young ice formed very fast we had to prepare for the third wintering. . . . The magnetic variation house and the meteorological station commenced working in the first part of October. In the spring of 1905 the east coast of Victoria Land was surveyed up to 72° 10′ W. lat. by Lieutenant Hansen on a sledge journey. On the same expedition the land seen by Rae was proved to be the group of islands mentioned above. The magnetic observations at King William Land were finished on June 1. The meteorological observations have been taken during the summer voyage. . . . I left Herschel Island on October 24 with dogs and sledge, and arrived here to-day.

According to a further message from Eagle City, Captain Amundsen intended to return to Herschel Island, and in the coming summer to complete the circumnavigation of the Arctic Regions by returning to Norway *via* the North-East Passage.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Twenty-First Anniversary Banquet.

To commemorate the Twenty-first Anniversary of the Society, a Banquet was held on the 27th November 1905, in the North British Station Hotel, Edinburgh. Lord Strathcona and Mount Royal, who was to have been one of the guests, was unfortunately prevented by illness from being present. There was a gathering of eighty-eight gentlemen.

Lectures in November.

On November 16, the Right Hon. the Viscount Mountmorres delivered a lecture before the Dundee Centre on his travels "Through the Heart of Central Africa," Mr. I. Julius Weinberg, J.P., F.R.G.S., Chairman of the branch, presiding.

The Right Hon. the Viscount Mountmorres repeated his address before the Aberdeen Centre the following evening, November 17, when Professor J. A. Thomson presided.

Sir Charles N. E. Eliot, K.C.M.G., C.B., opened the lecture session in Edinburgh on November 28, when he delivered an address on a journey "From Mombasa to Khartoum: through Uganda and down the Nile," Professor James Geikie, D.C.L., LL.D., President of the Society, presiding. On the motion of Colonel Cadell, V.C., a hearty vote of thanks was awarded to the lecturer.

At Glasgow, on November 29, Mr. R. N. Hall, F.R.G.S., delivered an address on "The Buried City of the Great Zimbabwe, Mashonaland." Dr. Paul Rottenburg occupied the Chair.

Mr. Walter James, K.C., Agent-General for Western Australia, addressed the Dundee Centre on 29th November and the Aberdeen Centre on 30th November on "Western Australia," Mr. G. K. Smith of Ardmere and Mr. George M. Cook respectively occupying the Chair.

Lectures in December.

On December 12, Sir Archibald Geikie, D.C.L., LL.D., F.R.S., delivered an address before the Society in Edinburgh on "The History of the Geography of Scotland," Brigadier-General the Lord Playfair, C.V.O., R.A., being in the Chair.

Before the delivery of the address, Brigadier-General the Lord Playfair, in the name of the Council, presented to Sir Archibald Geikie the Livingstone Gold Medal, in consideration of the distinguished services he has rendered to Geographical Science, notably the Physical Geography of Scotland. On the motion of Sheriff C. J. Guthrie, a hearty vote of thanks was awarded the lecturer.

At Glasgow, on 14th December, Mr. W. S. Bruce, F.R.S.G.S., delivered an address on the work of the "Scottish National Antarctic Expedition," Dr. Paul Rottenburg, Chairman of the branch, presiding.

On 14th December at Aberdeen, and on 15th December at Dundee, Mr. R. N. Hall repeated the lecture he previously delivered at Glasgow, Professor W. M. Ramsay and Mr. J. C. Buist respectively occupying the Chair.

CORRESPONDENCE.

Turner's "Siberia."

To the Editor, *Scottish Geographical Magazine.*

Edinburgh, 14*th December* 1905.

Sir,—In the review published in the December issue of the *Magazine* on Mr. Turner's recent book on "Siberia," I observe that that gentleman claims to have been the first Englishman to have trodden the wilds of the Altai Mountains and the first "human being" to describe their grandeur. I venture to call attention to the travels, in those same regions of Central Asia, of Mr. Thomas Witlam Atkinson, F.R.G.S. and F.G.S., for some seven years prior to 1853, the narrative of which, and of his further extensive journeys in surrounding countries, is contained in his book *Oriental and Western Siberia*, published in London in 1858 (pp. 611), with numerous illustrations from Mr. Atkinson's own pencil.

He visited and climbed to the foot of one of the twin peaks of Bieloukha, the Belukha of Mr. Turner, and gives a graphic account of its dangers and of the storm which drove him downwards with his two Kalmuck companions. The whole Altai region was explored by Atkinson at that time, and his descriptions convey vividly to the imagination the grandeur in form and colour of its scenery.

He is also the author of *Travels on the Amoor*, published in 1860 (pp. 570) to warn his countrymen of the Russian territorial acquisitions after the Crimean War. He was born in Yorkshire, 6th March 1799, and died at Lower Walmer, Kent, on 13th August 1861.—Your obedient servant,

William Graham.

PS.—Atkinson was on intimate terms of friendship with Prince Gortschikoff, the well-known Russian statesman.

GEOGRAPHICAL NOTES.

Europe.

The Monte Rosa Meteorological Observatory.—A note in *Nature* for October 5 gives an interesting account of the Regina Margherita Observatory, which is placed on the Signalkuppe peak of Monte Rosa, at a height of 4559 metres above sea-level. The difficulties of observation here seem even greater than in polar regions. It was

hoped that observations could be taken at the station from June 15 to September 15 each year, but the results for the first year (1904) were not wholly satisfactory, on account of the great difficulties to be overcome. The instruments and materials for the observatory had to be conveyed from Alagna partly by mules and partly by porters, and the cost of transport worked out at 62 centesimi for each kilogram (2·2 lbs.). During transit many of the instruments were broken. It was found exceedingly difficult to take observations owing to the intense cold, the clogging of the apparatus with hoar frost and violent snowstorms, and the intense electrification of the atmosphere. The shade temperature at the summit of Monte Rosa is practically always below freezing-point. The thermometers taken to the summit registered down to -20° C., but the temperature often fell below this point. The mean reading of the barometer was 17·1 inches for the period during which observations were taken, and in consequence water boiled at about 85° C. The lightning conductors frequently appeared like steadily burning candles, and the observers experienced very unpleasant shocks.

The Pastoral Industries of the Pyrenees.—In a recent issue of the *Revue Générale des Sciences* (xvii. p. 777), M. H. Cavaillès discusses the causes of the arrested development of the Pyrenees as compared with the other mountain regions of France and of Switzerland. In the Swiss Alps, the French Jura, in Savoy and even in parts of the Dauphiny, there has of late years been a great development of the mountain regions, owing largely to the adoption of the co-operative principle. As a result of association the products—chiefly milk, cheese, butter, wool, and meat—have been increased in amount, methods have been improved, distribution facilitated, and prosperity has resulted. Further, in the utilisation of the power of mountain streams a new source of wealth has been tapped in the mountains. Nor must one forget to add yet another source of wealth—the visitors whom the conditions of town life send every year to the hills. In consequence one may say that, in the general case, the tide of economic development, once confined to the plains, is now sweeping up the mountain slopes.

But the Pyrenees have as yet remained aloof from this changed condition of affairs. Wool, it is true, they produce in considerable amount, the total value for the year 1901 in the five French departments (Basses-Pyrénées, Hautes Pyrénées, Haute-Garonne, Ariège, Pyrénées-Orientales) amounting to over three million francs, but dairy products are relatively insignificant. In the year 1892 butter only yielded 1,200,000 francs, and cheese about 1,500,000 francs for the whole five departments, and this although there are markets in the shape of considerable towns near at hand, whose needs are at present largely supplied from Normandy and Brittany. The butter produced is often of poor quality, owing to want of care in its manufacture; while the cheese, which is made exclusively of goat's milk, is not valued outside the region of production. Thirty years ago it was calculated that, while the value in summer of the high pastures of the Alps rises to 100 francs per hectare, in the Pyrenees the figure never exceeds 10 francs,

and the mean is even less than 5 francs. Matters have scarcely changed since.

Owing to the force of modern competition, a country which is not growing richer is becoming impoverished; and this is true of the Pyrenees, whose slopes are yearly losing the most energetic members of the community, who are emigrating to the seaboard or further afield, whose pastures are degenerating, whose forests are disappearing.

What is the cause of this arrested development? Not the poverty of the soil, not the climate, but man himself, who has squandered the natural wealth of the region. The forests especially have been ruthlessly destroyed, forest fires being lamentably frequent. Nor does the mischief end with the destruction of the trees, for the soil itself has in many places disappeared as a consequence of the loss of its covering. It is in the Hautes-Pyrénées, Haute-Garonne, and Ariège, that most destruction has been wrought; but in the six departments (including the Aude), out of a total area of 1,276,000 hectares, only 310,000 hectares are now effectively wooded. Though the destruction of the forest has been avowedly carried out for the sake of the pastures, yet the pastures themselves have also suffered owing to the ignorance and want of method among the peasantry, who over-graze them, allow them to be overwhelmed by rock-falls, and generally to suffer from neglect. This in turn is partly due to the system of land tenure. The pastures of the high grounds and of many of these in the low country are communal property, and it is not to the interest of individuals to make the best use of them, to preserve the pasture, to construct roads or drinking places, as would be the case were they private property, or were the communal life more fully developed. The inhabitants of the Pyrenees are individualised to excess, and are nomads by instinct. Though much has been and is being done both by government and by private associations to educate and train them, yet the task is one of no small difficulty. M. Cavaillès regards as the most hopeful sign the foundation of a *Société pour l'aménagement des montagnes*, started about a year ago, which has drawn up a useful programme of improvements. It aims not only at arresting the impoverishment of the high ground in various ways, but further at providing object-lessons for the communities concerned in the shape of experimental plots treated according to the best methods. Already a considerable measure of success has followed the efforts of this Society, although much still remains to be done.

Asia.

The Provinces of Shensi and Kansu.—We have received a *Military Report* on these two provinces, which has been compiled by Captain U. L. Campbell from notes made during a journey through these provinces in 1903. The Report contains chapters on the general geography, climate, resources, and so forth of the provinces, in addition to a gazetteer of rivers and towns, an account of Captain Campbell's routes, and a bibliography, and is illustrated by several sketches and

plans. The report is incomplete in some particulars, but is intended to serve as a basis for the compilation of a more exhaustive work at a later date.

Africa.

The Mapping of East Africa.—In *Petermann's Mitteilungen* (x. 1905) there appears an interesting map of the Galla country accompanied by a short article by Professor Hahn. The map is based upon the most recent observations and journeys, and shows how the blank places are in process of being filled up. Blanks still exist, however, notably in the east of the map, in the region of the Webi, Ganale, and Daua rivers. It is in this region the Huku lake lies, still inadequately known. In the south also, between lat. 3° and 4° North, a considerable region, in which water-courses are absent, is also unknown. To the south of Lake Stephanie, again, lies a large area of unknown country. The blanks are the more to be regretted in that the region is one of great geographical interest. Thus it is the region in which the great East African rifts of north-south direction give place to those of south-east-northwest direction. To the first series belongs Lake Rudolf, while the two recently discovered Abyssinian lakes, Lakes Ganjule and Abaia, belong to the second. It is probable that Stephanie belongs to the Abyssinian series also. The two series do not seem to be connected. Rudolf has no prolongation to the north-east, and no gap appears in its eastern mountain wall; nor is it probable that Stephanie is continued southward by a depression into the unknown region to the south of the lake. The whole of East Africa shows a tendency to rift formation, and it is probable that the whole of the western boundary of Abyssinia marks a line of fracture.

Though the region must formerly have been a district of widespread and strong volcanic activity, now there are only feeble and scattered indications of volcanic forces. The lakes further show a tendency to diminish and dry up. Thus Stephanie only occupies a small portion of its own basin; and in view of the widespread tendency to desiccation in Africa it will be of interest to note the fluctuations of the newly-discovered basins. Much of the region under discussion is devoid of water-courses; and it is noteworthy that, on account of the elevation of the borders of the isolated portions of the system of rifts, few lateral streams coming from the distance can enter them. Thus while the Omo does finally reach the northern end of Rudolf, its near neighbour, the Sacchi, ends in a swamp shortly before reaching Sanderson Gulf. The western bank of the lake is not, however, so high as the eastern, and therefore the Turkwell contrives to reach it. In the extreme north-west of the map are some streams which join the Sobat system, while in the north-east are streams running in deeply-excavated valleys which finally join with the Juba.

The map is of special interest in that it includes the boundary between Abyssinia and British East Africa, a boundary which, as Professor Hahn remarks, it is high time to have finally settled. He is

of opinion that, sooner or later, there is bound to arise a "Lake Rudolf problem."

The Soils of Rhodesia.—In the *Proceedings of the Rhodesia Scientific Association* (iv. p. 52) Mr. John Cameron gives an account of the general characters of the soils of Rhodesia. As contrasted with some other new regions of the earth's surface, Rhodesia is, he states, characterised by the moderate fertility of its virgin soil. Owing to the rapid drainage and the periodical rainfall a soil fitted for cultivation is absent from much of the area, and it is only where the silt accumulates along the margins of the rivers and their tributaries that there are possibilities for agriculture. Elsewhere the surface consists of stony and sandy undulations, carrying a straggling and stunted growth of copsewood. Fortunately, however, the land area which has possibilities of agricultural development is very extensive.

The soils are classified by Mr. Cameron into the black and red soils, the latter containing iron predominantly, and the former lime. In all cases soil and subsoil are almost identical, and are mineral in character with a marked deficiency of vegetable matter. The black soils are for the most part sandy, and when fertile owe their fertility to the presence of a stratum of fine silt which gives them the power of retaining water. The red soils are derived from the decomposition of schists, and are singularly retentive of moisture; but, on the other hand, they are very resistant to evaporation, and will not readily yield their moisture to the growing plant.

Earthworms are rare in Rhodesia, and it appears to have been too hastily assumed that their place as soil-makers is taken by the abundant termites. Mr. Cameron is indeed of opinion that, on the other hand, the relatively low fertility of the soils is to be ascribed to the action of termites. Earthworms assist in the oxidation of organic matter, and leave it in a condition in which it is readily acted upon by the nitrifying organism; but it would appear that the termites, on the contrary, transform vegetable matter into a substance which is incapable of decay or further oxidation, and therefore sterilise the soil. The pipes, tunnels, and galleries which they build are lined with a cement-like substance which does not decay, and though the ant-heaps necessarily contain a large amount of nitrogenous matter, yet they are relatively sterile, apparently because the compounds are locked up in forms incapable of utilisation by plants. Again, trees falling on the veldt do not decay and form humus, but are acted upon by the termites, and as a result decay is prevented. In consequence, though the soils are rich in bases, humus is markedly deficient, and soil bacteria seem to be in consequence rare. On the whole, Mr. Cameron thinks that what is wanted in the soils of Rhodesia, more even than additional water, is the addition of organic matter, whose presence not only neutralises the injurious effect of the termites, but is itself highly inimical to the growth of the termite colonies. The general conclusion seems to be that a scientific study of the local conditions is necessary before great results can be expected from agriculture in Rhodesia, especially when beginning with soils in the virgin state.

America.

British Honduras.—In concluding his report (*Colonial Reports: Annual*, No. 455) on British Honduras for the past financial year, the Colonial Secretary describes the colony as one of great possibilities. "It is a land of forests and rivers, of wide areas of virgin soil, and, possibly, of mineral wealth. It may be safely predicted that in the course of time, when exploited by capital, the colony will hold its own as a rich possession of his Majesty. In a country the size of Wales, with a present population of less than forty thousand souls, advancement in material welfare must necessarily be slow, but the forward movement has lately been distinctly accelerated. Surveys have been made, plans completed, and specifications drawn up, of more than one line running from the coast to the interior, and there is good prospect of railway construction being undertaken in the early future." The figures given in the report show an increasing revenue in the last few years, a considerable excess of assets over liabilities in the fiscal year under review, and a public debt which is about half a single year's revenue. Trade also shows a satisfactory increase of late years. The United States sends more than half the imports, and its share is increasing, while that of the United Kingdom slowly decreases and is now rather more than a quarter of the whole. The population last year was 39,688.

General.

International Anthropological Congress at Monaco.—The thirteenth session of the International Congress of Prehistoric Anthropology and Archæology will be held at Monaco from 16th to 21st April next, under the patronage of H.S.H. the Prince of Monaco. Among other excursions, one will be to the caves near Mentone of the Baoussé Roussé (Rochers rouges) described in this *Magazine* for June 1903, where is found the human type of Grimaldi (negroid) and other vestiges of Prehistoric Man, and where excavations will be made in presence of the Congress. Numerous questions relating to Prehistoric Man will be discussed by the Congress, which will also be honoured by a series of *fêtes*, including a reception by the Prince at the Palace of Monaco, an illumination of the Bay of Monaco, and a gala representation at the theatre of the Casino of Monte Carlo. Communications should be addressed to M. le Dr. Verneau, Secrétaire général du Comité d'organisation, au Laboratoire d'Anthropologie du Muséum, 61 rue de Buffon, Paris.

The International Exploration of the North Sea.—We have received the Report of the work done during the years 1902-3 for the Fishery Board of Scotland, acting in conjunction with the International Council for Exploration of the Sea. The importance of the investigations being carried on may be realised from the following quotations from the Report, which has been prepared by Professor D'Arcy Thompson.

Speaking of the North Sea, Professor Thompson says in his introduction :—

"Into the North Sea pour warm, salt water from the Atlantic, colder

and less salt water from the far north, and fresher waters, very variable in temperature, from the rivers and from the Baltic Sea; and these several constituent waters may be scanty or abundant, comparatively pure, or variously mixed, according to place and season. It is not merely matter of surmise, but there is already evidence at hand to prove that the normal distribution and regular movements of many fishes are linked with these physical phenomena, and to indicate that hydrography holds the clue to the wanderings of the shoals. Together with these hydrographical problems goes the kindred study of the 'plankton' or multitudinous floating life that is variously associated with particular waters and that serves as food for a variety of fish."

Again, in connection with an investigation of the hydrographical conditions which prevail in the Faröe Channel and in a region lying between the north of Scotland and the Norwegian coast, the following remarks occur after a statement that the work has not yet been carried on long enough for definite conclusions to be drawn :—

"But we now see at least good reason to believe that the great Atlantic inflow which sweeps round the north of Scotland is indeed periodic, growing in intensity through the winter until early spring and then subsiding until autumn. This salt Atlantic water covers a wide area of the North Sea in winter and spring, but as summer comes on it is encroached upon and overflowed by fresher and warmer water from the eastward (much of it, as Dr. O. Pettersson suggests, from the deep channel off the Norwegian coast), until in September these latter waters withdraw eastward again. We are much inclined to believe that the great summer herring fishing comes and goes with this annual ebb and flow, and much of our recent hydrographic work since the date of that with which the present volume deals, has been directed to the study of this important subject."

These quotations may serve to show that the work has both a scientific and a practical significance, and in this connection it is interesting to note that the Japanese are sending experts to Copenhagen, and to the Baltic and North Sea waters to study the methods of the International Council, presumably in connection with their own recent acquisition of important fisheries off Sakhalin.

Determination of Variations of Latitude.—According to a note in *Science* for October 13, the Central Bureau of the International Geodetic Association has definitely fixed upon two stations in the Southern Hemisphere for the determination of variations of latitude. The observations will begin on January 1, 1906. One station is in South America, at Oncativo, a village in the Argentine Republic, on the Argentine Central Railway, 72 kilometres from Cordova, and 622 kilometres from Buenos Ayres. It is located on a plain with favourable topographic and climatic conditions. The temperature ranges from -6° to $+40^{\circ}$ C., and the mean cloudiness on the usual scale is expressed by 4. The rainy season occurs in summer, when the rainfall amounts to 700 mm. Dr. Luigi Carnera has been appointed observer. The other station is in Australia, at Bayswater, a town 6 kilometres north-east of

Perth, the capital of West Australia. There the annual range of temperature is between 0° and +40° C., and the mean cloudiness varies from 2 in summer to 5 in winter. The annual rainfall amounts to 870 mm. Dr. Curt Hessen will be in charge of the observatory here. Both the stations are in latitude 31° 55′ S.

At the observatory of Pulkowa, in latitude 59° 46′ N., a series of observations is in progress to supplement those at the station named above, and it is expected that the observatories at Leyden and at Tokio will also co-operate.

Temperatures in the Southern Indian Ocean.—We have received a pamphlet on the surface temperatures in the southern part of the Indian Ocean during the years 1901-3 by Mr. Rudolf Lütgen, the pamphlet being a thesis for the degree of Doctor of Philosophy in the University of Berlin. Its interest lies in the bearing of the results upon the question of variations of temperature in the Antarctic region. The author is of opinion that there is much evidence for the occurrence of periodical variations in climate in the Antarctic. The experiences of the various Antarctic expeditions since the German one of 1882-3 speak to such variations, but in view of the fact that Antarctic expeditions are necessarily sporadic, the author points out that, in his estimation, the conditions in the Antarctic can be ascertained by the varying conditions in the Indian Ocean. He finds that, while the surface temperature in the eastern portion of the South Indian Ocean are approximately constant, there is much variation in the western and middle portions. In the year 1901 and the first part of 1902 the variations from the mean were slight, but in the southern winter of 1902 and onwards to the summer of 1903 there was an increasingly negative variation, until towards the end of 1903 the temperatures again became normal. These lowered surface temperatures must be caused by the inflow of cold masses of water under the influence of the west wind drift, and are apparently in causal connection with abnormal conditions of temperature in the Antarctic. Thus the results confirm the view that the temperature conditions prevailing in the Antarctic during the international campaign of 1902-3 were abnormally low, and that as a consequence the surface temperatures were lowered in the South Indian Ocean.

Commercial Geography.

Railways in Siam.—The Acting British Consul at Bangkok reports that a new railway was opened in Siam in January last. The line is of one-metre gauge, and runs from Bangkok to Tachin, an important fishing town at the mouth of the river of the same name. The length of the line is 33 kilometres, and a proposal to continue it for another 33 kilometres to the mouth of the Meklong is under consideration.

Much further to the east there is talk of the construction of a railway which would avoid the rapids on the course of the Mekong river. This river, as is well known, is for part of its course the boundary between the kingdom of Siam and the French possessions in Indo-China, and

though of large size, its commercial value is greatly diminished by the difficulties of navigation in the lower part of its course. During the early part of the present year Lieutenant Giraud of the Colonial Infantry has been engaged in a survey of the country bordering the right bank of the river, with a view to determining the best route for the proposed line.

The mission started from Kompong Cham, a little above the important centre of Pnom Penh, on the lower river, and concluded its labours at Ubon, some two hundred and fifty miles north as the crow flies, a well-known town on the Nam Mun, a right-bank tributary of the Mekong. Lieutenant Giraud reports that the work of constructing a railway between these two points would present no special difficulties, and he has laid down on the maps what he considers to be a suitable route. The intervening stretch of the Mekong comprises some of the worst of the rapids, and the construction of the line would no doubt materially facilitate communication with the Laos territories, and promote the development of their resources, though such a line can only be regarded as a first instalment of the railways necessary to the complete achievement of this object. The proposed route lies entirely in the western half of the Mekong basin, as any route is practically bound to do, in consequence of the configuration of the country. One result of this is that, notwithstanding the recent extension of the French frontier, the route from the Pnom-dang-rek range to Ubon runs through Siamese territory. It is probable, however, that this fact would not greatly interfere with the execution of the project, should the French Government finally adopt the scheme, for in the Franco-Siamese Treaty of February 1904 it is laid down that the two Governments shall effect an agreement on the subject of the construction of such railway lines as may be recognised as necessary owing to the rapids that obstruct navigation along the Mekong. It is noteworthy, also, that the Siamese Government is bound to come to an agreement with the French Government as to the construction and working of any railways which Siam wishes to construct in the Siamese portion of the Mekong basin, unless Siam can carry out the enterprise by the exclusive aid of her own resources.

NEW BOOKS.

ASIA.

The Far East. By Archibald Little. Oxford: At the Clarendon Press, 1905.

The Far East, which is described by Mr. Little in this volume of "The Regions of the World" series, includes China, with its dependencies, viz. Manchuria, Mongolia, Turkestan, and Tibet: Chinese former dependencies, viz. French Indo-China and Corea: and the two independent states of Siam and Japan. The work shows indications that, as Mr. Little says, it was written in "intervals of business," and the descriptions of the topography and orography of the huge Chinese Empire are somewhat, although perhaps necessarily, monotonous. On the other hand, when we consider the vast extent of the countries which Mr.

Little describes, it has to be admitted that it would probably have been impossible to condense the descriptions into smaller compass without detracting from the completeness and value of the work. Whenever suitable opportunity occurs, Mr. Little has enlivened his pages with interludes of historical or political interest. We suppose that he must be considered the greatest authority living on the Far East as defined in this work, and his observations and deductions accordingly are entitled to unusual weight. We may justly pride ourselves on our civil and military administration in the Colonies; nevertheless we will do well to ponder such remarks as the following from Mr. Little:—"The French municipal administration is ages in advance of anything known in British colonies; not only is everything conceivable done for the health, comfort, business needs, and pleasure of the present inhabitants, but a wise forethought, which seems to be absolutely lacking in our dependencies and Crown colonies, provides amply for future expansion. . . . In the amenities of life, in arrangements for preventing native overcrowding, and in sanitation generally, in wide streets, open places, strict building rules, and, above all, in a careful provision for a future extension of the city on a prearranged plan, Hanoi and Haiphong stand pre-eminent. Bombay and Calcutta display far more solid wealth and activity, but in elegance as well as in the practical amenities of city existence will bear no comparison with Saigon and Hanoi. The latter city now claims to be the healthiest of all European settlements in sub-tropical Asia." Mr. Little began his travels in and experiences of China so long ago as 1860, and thus he writes with the ease and confidence of the man who has been over the ground he describes and knows it well. His subject does not usually or readily lend itself to picturesque or eloquent treatment, but neither picturesqueness nor eloquence is wanting when opportunity permits. As is the case in all the preceding volumes of this series, the task of the reader is greatly facilitated by excellent maps and diagrams, and there are also some very good photographs.

John Chinaman at Home: Sketches of Men, Manners, and Things in China. By Rev. E. J. Hardy, M.A. London: T. Fisher Unwin, 1905.

Since the Boxer rebellion in China the attention of Western nations has been more than usually drawn to the affairs of the Celestial Empire. Of the many books written about China and the Chinese this is one of the best. Mr. Hardy has made a good use of his opportunities during a three years' sojourn within the "Middle Kingdom." He gives a most interesting account of the manners and customs of the Chinese. Although he touches on an infinite variety of subjects, they are all described with the greatest fidelity, as any one acquainted with the country will at once acknowledge.

Besides describing several of the cities, he discourses upon such subjects as food, dress, medicines, clothes, labourers, gardens, etc., and the ceremonies attending marriages, deaths, funerals, superstitions, and religions. Although unacquainted with the language, he has collected an immense amount of information about the characteristics of Chinamen. The book is most entertaining. It has several excellent illustrations.

Wanderings in the Great Forests of Borneo. By Dr. Odoardo Beccari. Revised and edited by F. H. H. Guillemard, M.A. Pp. xxiv + 424. London: Constable, 1904.

This present volume is a translation of the work of the Italian botanist, Dr. Beccari. Although the travels of Beccari are now forty years old (1865) the primeval forests have not changed, and it is with these forests, with nature rather than with man, that the author is concerned.

The naturalist, and especially the botanist, will find in Dr. Beccari's work a mine of information. The ethnographer and the sociologist will not, perhaps, be so generously rewarded for the trouble of accompanying the author through the swamps and virgin forests of Sarawak. No doubt the proper study of the botanist is botany: but after all, for the general reader, the interest of Borneo lies in its native population.

Beccari himself describes in his Preface the characteristic features which lend such a fascination to Borneo in the eyes of the ethnologist and the political philosopher:- "In Borneo, the largest island of Malaysia, an English Rajah and an English Ranee rule with pure autocracy a state which, in area, equals England and Wales, and has its fleet and its army, yet is without telegraphic communication with the rest of the world: possesses not only no railroads, but no roads, and is clothed by dense and interminable forests, on which wander the orang-utan. Here the natives live a primitive life, are in part still mere savages, true man-hunters, who delight in hanging in their houses the smoked skulls of their human victims as a homage to imaginary supernatural spirits and as a proof of their bravery."

It is precisely because the kingdom of Sarawak is one of the few regions of our planet where civilisation has not yet "spoilt" the untutored children of nature, where neither railway nor telegraph have yet penetrated, that it would have been of such surpassing interest to have an accurate study of the condition, the habits and beliefs of the Borneo natives. Such a study Beccari does not give us. The information contained in the second and in the twenty-fourth chapters can hardly be said to add much to our knowledge on the ethnology of the Borneo savages.

With this important reservation, we cannot commend too heartily this volume. Graphically written and well illustrated, it is a most welcome addition to the by no means abundant literature on Borneo.

AFRICA.

Erythräa und der Aegyptische Sudän. By Professor Dr. E. D. Schoenfeld. Pp. iv+245. Berlin: Dietrich Reimer, 1904.

Professor Schoenfeld, already favourably known through his work on Tripoli, gives us in the present volume a record of his travels from Massowa to Khartum, and a historical account of recent events in the Egyptian Soudan. He speaks most favourably of the work done by the Italians in their ill-fated colony of Erythrea, which contrasts with the much less sympathetic tone in which he describes the achievements of the British. As a German imperialist he may perhaps be pardoned, but as a traveller he ought to be grateful to the civilising influence of a government which enabled him to reach Khartum from Massowa in less than six weeks, wandering through regions which, before Omdurman, were practically inaccessible to the European. Professor Schoenfeld, we may say, repeatedly prophesies a resurrection of Mahdiism in the Soudan.

There is at the beginning of the volume a very interesting passage, which indicates the imperialist tendencies of the author:—

"Here, just opposite Massowa, on the island Kuma, which belongs to the group of islands Farisan el kebir, the German Government, with the consent of the Sultan of Turkey, has acquired the right to establish a coaling station. It is also said that it is intended to erect here a lighthouse, a harbour, and fortifications."

Professor Schoenfeld enthusiastically supports the last-named scheme, and sees in it the germ of the expansion of the Vaterland in those regions. He quotes in this connection the opinion of a French Colonial writer on the political and strategic importance of the new German coaling station :—

"The choice of this point is excellent, for it commands the first-rate harbour of Hodeida, the starting-point for the caravans to Sana, a town situated in the most fertile and most popular part of the Yemen. It may also be used eventually as a basis of operation in the event of a German intervention in the Holy Land for the protection of Catholics."

Professor Schoenfeld's book is most pleasantly written, and illustrated with fifteen magnificent photographs, which put to shame the usual type of illustrations.

AMERICA.

The Story of Exploration: The St. Lawrence Basin. By Samuel Edward Dawson, LL.D., F.R.S.E. London : Lawrence and Bullen, Limited, 1905. *Price 7s. 6d.*

The editor of "The Story of Exploration" series was very fortunate in securing as the writer of this volume on *The St. Lawrence Basin* the learned honorary secretary to the Royal Society of Canada, Dr. Dawson, who had already proved his capacity to deal with the subject by his work on "The Voyages of the Cabots." In this work we have an erudite, thoughtful, and exhaustive description of the work of exploration from the times of John Cabot to the end of the seventeenth century, when the task of exploration was completed, and the territory explored became the scene of struggle after struggle, and battle after battle between the English and the French, its ultimate destiny being decided not by what happened in Canada, but by the fate of war in Europe. It has to be confessed that the English can claim but a very insignificant share in the exploration of the St. Lawrence Basin ; in fact the only English name of importance is that of Henry Hudson, who in the year 1610 sailed into and discovered what is known as Hudson's Bay, and spent the winter in the extreme south of it, now known as James Bay. Cabot was a Genoese in the employment of the English King Henry VII. Readers of Hakluyt will remember that in 1492 Christopher Columbus sent his brother Bartholomew to King Henry of England, with letters offering him his services, but ere the Tudor monarch could make up his mind Christopher Columbus had found favour in the eyes of Isabella of Castille and had started on the voyage which resulted in the discovery of America. Apparently when Cabot made his offer King Henry was resolved not to make the same mistake again, so he promptly sanctioned Cabot's project on the characteristic conditions that it was not to prejudice the rights of the Kings of Spain and Portugal, and that Cabot was to pay his own expenses. The project, of course, was to find a passage to the Kingdom of Cathay. Undaunted by such feeble support, Cabot set to work ; but he could procure only one small vessel, the crew of which numbered only eighteen men, and in this he sailed from Bristol in May 1497, and after a fifty days' voyage he sighted land at Cape Breton—the real discoverer of Canada. The glory and credit, however, of discovering Canada have been repeatedly claimed for others, such as the Basques and the Portuguese. Dr. Dawson in a brief but convincing chapter examines the most prominent of these claims, and shows their futility.

It was one thing to discover Canada, and quite another thing to explore it. The exploration of the St. Lawrence Basin was accomplished by Frenchmen, and,

we may say, by Frenchmen alone. Among the many illustrious names connected with this work two stand out far ahead of all their famous comrades, viz. Jacques Cartier and Samuel de Champlain, and Dr. Dawson tells their story with generous enthusiasm and sincere admiration. It is indeed one of which any nation may be proud. Truth, we know, is stranger than fiction, and the simple story of these two brave men is filled with scenes of excitement and romantic interest, such as might be expected in the pages of romance rather than in the records of sober history.

The story is admirably told by Dr. Dawson in graphic and picturesque language, in sufficient but not unnecessary detail, and with a well-balanced judgment as to the relative importance of the facts. The exploits of Cabot, Cartier, and Champlain naturally bulk largely in this work, but ample and judicious recognition is also given to such men as Etienne Brulé, La Salle, and Dulhut, to select only a few among many famous men; and the fervid missionary zeal and patriotic self-sacrifice of the Recollet, Jesuit, and Sulpician fathers, who knowingly went to martyrdom at the hands of ferocious Iroquois and Ottawas, are heartily and warmly acknowledged. The work is one which we cordially recommend to our readers, and we must add that it is equipped with an excellent map, and is embellished with many beautiful photographs.

GENERAL.

Everyday Life among the Head-Hunters. By Dorothy Cator. London, New York, and Bombay: Longmans, Green and Co., 1905.

We gather from what "Dorothy Cator" tells us in this book that her husband is a magistrate in the Colonial Civil Service, who, in the course of his career, has had the good (or bad) luck to be sent into the wilds of Borneo, and into the hinterland of Sierra Leone. On both occasions he was accompanied by his wife, and in this volume she gives us a very interesting and pleasantly written account of some of her observations and impressions. Neither of these localities is popular in the colonial service, and for the best of reasons; they are extremely unhealthy, and are inhabited by savages, who even yet are far removed from the elementary stages of civilisation. The conditions of everyday life in them are such as to be barely tolerable even to a man, so it argues unusual courage and nerve on the part of the writer that, not only did she endure them, but she seems even to have enjoyed them. In Borneo, the headquarters where apparently she spent the most of her time, was at Sandakan, and from there she and her husband made an expedition up the Kinabatangan river into the country of the Dusuns, Muruts, and Dyaks, and lived for some time among the Romanows and Fingaras, head-hunting tribes, among whom she had some thrilling experiences, as, for example, when she was left by her husband sole guard over a Dyak prisoner who had committed a murder. The description of her bedroom in the Romanow country is interesting. "One-third of the house all up one side was boarded off, and divided into extraordinary little boxes for the women and children. The kitchen and store-room were also there, and the whole place looked very like an untidy hen-house on a large scale. The kitchen was very simple, just a flat stone fireplace with no means of carrying off the smoke, which was allowed to escape where it liked. At night we all slept in one serried row, packed like sardines, the whole way down this hugely long house. I slept at the top, then Dick, then all the other men quite close up to us, only divided by a mosquito

curtain and a shallow step, and our only means of going in and out was by more or less swarming a very thin, nearly perpendicular trunk of a tree with notches cut in it. This was stuck up at the extreme end of the house right away from us; and I shall never forget it, as I was very ill once up there, and the picking my way in a half-fainting condition at night over all those sleeping and never-ending men's legs whenever I wanted to get into the air, and the swarming backwards and forwards at the other end, is still almost like a nightmare to me. This all living together in civilised countries would mean endless rows; but all the time we were living with these head-hunters we were struck with their gentleness and the extraordinary peacefulness of their home-life."

From Borneo, after enjoying a short furlough home, the writer's husband was sent to the hinterland of Sierra Leone, where his duties took him into the tracts occupied by the Mendi and Timani tribes. Here the ordinary amenities and comforts of life seem to have been as conspicuously absent as in Borneo. "In villages," says the writer, "where there is no court-house, the villagers brush out a mud hut for us, and if they wish to do us special honour—which happens, unfortunately, rather often—they plaster the verandah with fresh manure just before we arrive. Well-meant attentions are often very difficult to appreciate, and that certainly is. There are other little disadvantages about mud huts; rats and cockroaches, spiders two or three inches across, and centipedes insist on sharing them with you, and when it is raining you may wake with a cold trickle running down one arm, or you hear the water splashing down on the clothes you are going to wear next morning: and it doesn't improve your temper when you leap up to see what can be done, and find your shoes half full of water; but fortunately we are generally so tired when night comes that nothing keeps us long awake. . . . Life in the bush certainly has its drawbacks, and occasionally, when you are eaten up by mosquitoes and other poisonous little insects, and centipedes and other crawling things will choose you as their playground, and winged things will buzz in your face and fall into your food when you are tired, and driver-ants will insist on marching in an army through your house and taking possession of every hole and corner of it, killing everything they can find, and making you fly out into the bush perhaps in the very middle of the night to escape their fiery stings, and black people will smell even more than usual, the drawbacks weigh very heavily: but we often forget them all in the advantages."

Dorothy Cator evidently took a great interest in the secret societies which permeate, and are so characteristic of, the native tribes of the West African hinterland, but she takes a much more lenient view of them than is usually taken. Readers of Mr. Alldridge's able work on *Sherboro and its Hinterland* will remember how these societies are denounced by an officer whose experience of the conditions of native life in the West Coast and hinterland of Africa is probably unrivalled.

The book is illustrated by some very good photographs.

In Search of El Dorado: A Wanderer's Experiences. By Alexander Macdonald, F.R.G.S., with Introduction by Admiral Moresby. London: T. Fisher Unwin, 1905. Pp. 291. 33 Illustrations.

Mr. Macdonald has found gold in Klondyke, Western Australia, and New Guinea; opals in Queensland and New South Wales; rubies in Western Australia, and kauri gum in New Zealand, not to mention pearls in the Gulf, and adventures everywhere. For he is one of those who have "shouted on seven-ounce nuggets—starved on a Seedeeboy's pay." Though in justice to him we should say

that he always figures as "the boss," and he it was who was chosen by the starved miners of Dawson City to lead them in their desperate midwinter struggle to break back to civilisation and food. In spite of slips, the various stories are capitally told—"The Land of the Thron-Diucks" and "The Five Mile Rush" are specially good. Many strange sights and scenes are depicted. The author witnessed a genuine corroboree and tasted pidcherie in the back blocks, while through all the tales there runs the irrepressible humour of his henchman, Mac. Mr. Macdonald has evidently other tales to tell, and we hope that he will give them to the public. One general point we may refer to. Those who care to know the correct pronunciation of foreign place-names, even when not of importance, would welcome information in travellers' books. There are, for instance, at least five ways of pronouncing Wangeri. Which of these is the right one? A word would tell us.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Economic Geology of the United States. By Heinrich Ries, A.M., Ph.D., Assistant Professor of Economic Geology at Cornell University. Demy 8vo. Pp. xxi + 432. *Price* 8260. New York : Macmillan and Co., 1905.

The Source of the Blue Nile. A Record of a Journey through the Sudan to Lake Tsana in Western Abyssinia, and of the Return to Egypt by the Valley of Atbara; with a Note on the Religion, Customs, etc., of Abyssinia. By Arthur J. Hayes, and an Entomological Appendix by E. B. Poulton, LL.D., F.R.S., L.S.A., London. Demy 8vo. Pp. xii + 315. *Price* 10*s.* 6*d.* Smith Elder and Co., 1905.

La Colonisation et les Colonies Allemandes. Par André Chéradame. 8vo. Pp. ii + 485. *Prix* 12 *fr.* Paris : Plon-Nourrit et Cie., 1905.

La Belgique : Institutions, Industrie, et Commerce. J. Goemaere, Editeur, Bruxelles. Large 8vo. Pp. xx + 869. Bruxelles, 1905. [Presented by the Minister of Industry and Travel.]

Australian Life in Town and Country. By E. C. Buley. ("Our Empire" Series.) Crown 8vo. Pp. viii + 207. *Price* 3*s.* 6*d. net.* London : George Newnes, Ltd., 1905.

Old Maps and Map-Makers of Scotland. By John E. Shearer, F.S.A. Scot., F.R.S.G.S. Royal 8vo. Pp. viii + 86. *Price* 10*s.* Stirling : R. S. Shearer and Son, 1905.

Also the following Reports :—

Report on the Administration of Coorg for the Year 1904-1905. Mercara, 1905.

Report of the United States Fish Commission, vol. xxiii., 1903. Parts I. and II. Washington, 1905.

Report of the Chief of the Weather Bureau, 1903-1904. Washington, 1905.

The Anglo-Egyptian Sudan: A Compendium prepared by Officers of the Sudan Government. Edited by Lieut.-Colonel Count Gleichen, C.V.O., C.M.G., D.S.O. Two volumes. Vol. i.—Geographical, Descriptive, and Historical. Vol. ii.—Routes. Vol i. pp. xiii + 371. Vol. ii. pp. viii + 236. *Price* 10*s.* Printed for His Majesty's Stationery Office by Harrison and Sons. London, 1905.

The Geology of Argyll. By J. B. Hill, R.N. (Memoirs of the Geological Survey.) Explanation of Sheet 37. Demy 8vo. Pp. viii + 166. *Price* 3*s.* Edinburgh: Geological Survey Office, 1905.

Who's Who, 1906. Crown 8vo. Pp. 1878. *Price* 7*s.* 6*d.* London: A. and C. Black, 1905.

Hazell's Annual for 1906. *A Cyclopædic Record of Men and Topics of the Day.* Edited by W. Palmer. Crown 8vo. Pp. 640. *Price* 3*s.* 6*d.* London: Hazell, Watson and Viney, 1906.

The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Twenty-second Annual Issue. Demy 8vo. Pp. viii + 309. *Price* 7*s.* 6*d.* London: Chas. Griffin and Co., 1905.

Papers and Reports relating to Minerals and Mining, New Zealand. Wellington, 1905.

The Meridian Chronometer. By C. Robertson, M.D. [Presented by the Author.]

District Gazetteer of the United Provinces of Agra and Oudh. Vols. xxxiv., xxxix., xli., xlvii., and xlviii. Compiled and edited by H. R. Nevill, I.C.S. Allahabad, 1904.

District Gazetteer of Rajputana. Vols. i.-*a* and i.-*b*. Ajmer, 1904.

District Gazetteer of Madras. Twelve volumes. Madras, 1905.

Lloyds' Register of British and Foreign Shipping, 1904-1906. With Supplements. London, 1904. [Presented by Mr. William Lindsay.]

Publishers forwarding books for review will greatly oblige by marking the price *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st October 1905:—One-inch Map (third edition, engraved in outline).—Sheets 3, 4, 12, 20. Price 1s. 6d. each.

Six-inch and larger Scale Maps.—Six-inch Maps (Revised), full sheets, heliozincographed, without contours. *Inverness-shire.*—Sheet 29. Price 2s. 6d.

Quarter Sheets, heliozincographed, with contours. Price 1s. each. *Banffshire.*—7 SE.; 13 SW.; 23 NE. Without contours. *Elginshire.*—32 SE. Price 1s. each.

1 : 2500 Scale Maps (Revised), with Houses ruled, and with Areas. Price 3s. each. *Elginshire.*—Sheets ii. 9, 14, 15, 16; iii. 13; v. 12, 16; vi. 7, 9, 10, 11, 15; viii. 1, 5, 9, 13; x. 8; xi. 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; xii. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. *Nairnshire.*—Sheets i. 16; ii. 13; v. 1. *Sutherland.*—Sheets xciv. 12, 16; xcv. 13; ciii. 1.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st October 1905:—Six-inch Maps, full Sheets, uncoloured. Price 6s. each. *Island of Skye* (*Inverness-shire*).—Sheets 38, 39, 44.

ORDNANCE SURVEY OF SCOTLAND. The following publications were issued from 1st to 30th November 1905:—One-inch Map (third edition), engraved, with hills in brown or black.—Sheet 30—Price 1s. 6d. Third edition, printed in colours and folded in cover, or flat in sheets. *Dumfries*—Sheet 10; *Kelso*—Sheet 25. Price, on paper, 1s. 6d; mounted on linen, 2s. each.

Six-inch and larger Scale Maps. Six-inch Maps (Revised), full sheets, engraved, without contours *Ross and Cromarty.*—Sheets 15, 31, 32, 33, 44, 49, 57, 60, 62, 124—Price 2s. 6d. each. Sheet 122—Price 2s.

Quarter Sheets, heliozincographed, with contours (Price 1s. each). *Banffshire.*—1 SE.; 2 SW; 7 NE.; 13 NE.; 18 NE.; 18 SE.; 19 NW.; 23 SE.; 24 NW.; 24 NE.; 25 NW.; 25 SW. *Elginshire.*—13 NE.; 13 SE.; 14 NE.; 17 SW.; 18 NE.; 18 SW.; 19 (NW. and NE.); 23 NW.; 26 NE.; 26 (SW. and SE.); 31 SW.

Without Contours Price 1s. each). *Banffshire.*—35 NW. *Elginshire.*—2 (NW. and NE.); 29 SW.; 29 SE.; 30 NE.; 30 SE.; 32 NW.; 32 NE.; 33 NW.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Elginshire.*—Sheets I. 15 (16 and 12; II. 13; VI. 4, 8, 12, 16; VII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XI. 5, 6; XII. 1, 2, 3, 4. *Inverness-shire.*—Sheets II. 12, 14, 15, 16; III. 9, 10, 13. *Ross and Cromarty.*—Sheets XCVIII. 8; CI. 5. *Sutherland.*—Sheets CI. 8, 12; CII. 4, 8, 9, 12, 13.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

IRELAND.—Bartholomew's "Quarter-inch to Mile Map." Sheet 5—Cork and Killarney. Reduced by permission from the Ordnance Survey, and coloured in contours to show height of land. Roads revised by the Cyclists' Touring Club. Price 1s. paper; 2s. mounted on cloth and in case.

John Bartholomew and Co., Edinburgh.

ASIA.

CHINA.—Map showing Mission Stations. Scale 1 : 6,000,000. By J. G. Bartholomew. 1905. *China Inland Mission, London.*

TIENTSIN.—Map of the Tientsin Prefecture and neighbouring country. Scale 1 : 63,000, or 1 mile to an inch. Compiled in the Intelligence Branch, North China Command, under direction of Lieut.-Col. A. W. S. Wingate and Lieut. F. G. Turner, R.E. 1903. In 4 sheets. Price 1s. 6d. each sheet.

Topographical Section, General Staff, London.

AFRICA.

AFRICA.—General Staff Map on scale of 1 : 1,000,000, or about 16 miles to an inch. District sheets—16, Alexandria; 59, Falaba; 94-95, Kilimanjaro; 107-108, Mossamedes; 109, Lialui; 113-114, Kunene River; 119, Walfisch Bay; 120, Kalahari; 124, Molopo River. 1905. Price 2s. each.

Topographical Section, General Staff, London.

LAGOS AND SOUTHERN NIGERIA.—General Staff Map on Scale of 1 : 1,000,000, or about 16 miles to an inch. 1905. Price 3s.

Topographical Section, General Staff, London.

LIBERIA.—General Staff Map on Scale of 1 : 1,000,000 or about 16 miles to an inch. 1905. Price 2s. *Topographical Section, General Staff, London.*

NORTHERN NIGERIA.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheets 51-J, 51-K, 51-L, 51-N, 51-O, 51-P, 52-I, 52-M, 63-E, 63-I. 1905. Price 1s. 6d. each sheet. *Topographical Section, General Staff, London.*

PORTUGUESE EAST AFRICA.—Based on "Carta de Moçambique, 1903," with additions and corrections. Scale 1 : 3,000,000, or about 48 miles to an inch. 1905. Price 2s. *Topographical Section, General Staff, London.*

SIERRA LEONE—General Staff Map on Scale of 1 : 1,000,000, or about 16 miles to an inch. 1905. Price 2s.
Topographical Section, General Staff, London.

SIERRA LEONE PENINSULA.—Scale 1 : 63,000, or 1 inch to a mile. Contoured. 1905. Price 2s. 6d. *Topographical Section, General Staff, London.*

AMERICA.

DOMINION OF CANADA.—Map showing Natural Resources. Scale 1 : 12,000,000. By James White, F.R.G.S., Geographer. With statistical text. 1905.
Department of the Interior, Ottawa.

MANITOBA, SASKATCHEWAN, AND ALBERTA.—Scale 1 : 792,000, or 12½ miles to an inch. James White, F.R.G.S., Geographer. Special edition, showing even-numbered sections finally disposed of. 3 sheets. 1905.
Department of the Interior, Ottawa.

NEW BRUNSWICK.—Standard Topographical Map—Sheet 13. St. John Sheet—Scale 1 : 500,000, or about 8 miles to an inch. James White, F.R.G.S., Geographer. 1905. *Department of the Interior, Ottawa.*

SASKATCHEWAN AND ALBERTA.—Special Map showing Electoral Divisions, 1905.

SOUTHERN ALBERTA.— „ „ „

SOUTHERN SASKATCHEWAN.— „ „ „
Department of the Interior, Ottawa.

SOUTH AMERICA.—Philip's Comparative Series of Large Schoolroom Maps. Size 74 × 59 inches. Scale 1 : 6,000,000, or 95 miles to an inch. 1905. Price 16s., mounted on cloth, rollers, and varnished.
George Philip and Son, Ltd., London.

This is the latest addition to Messrs. Philip's new series of school wall-maps. Like the others of the series, it shows the physical and political features with great effect, and is admirably adapted for teaching purposes.

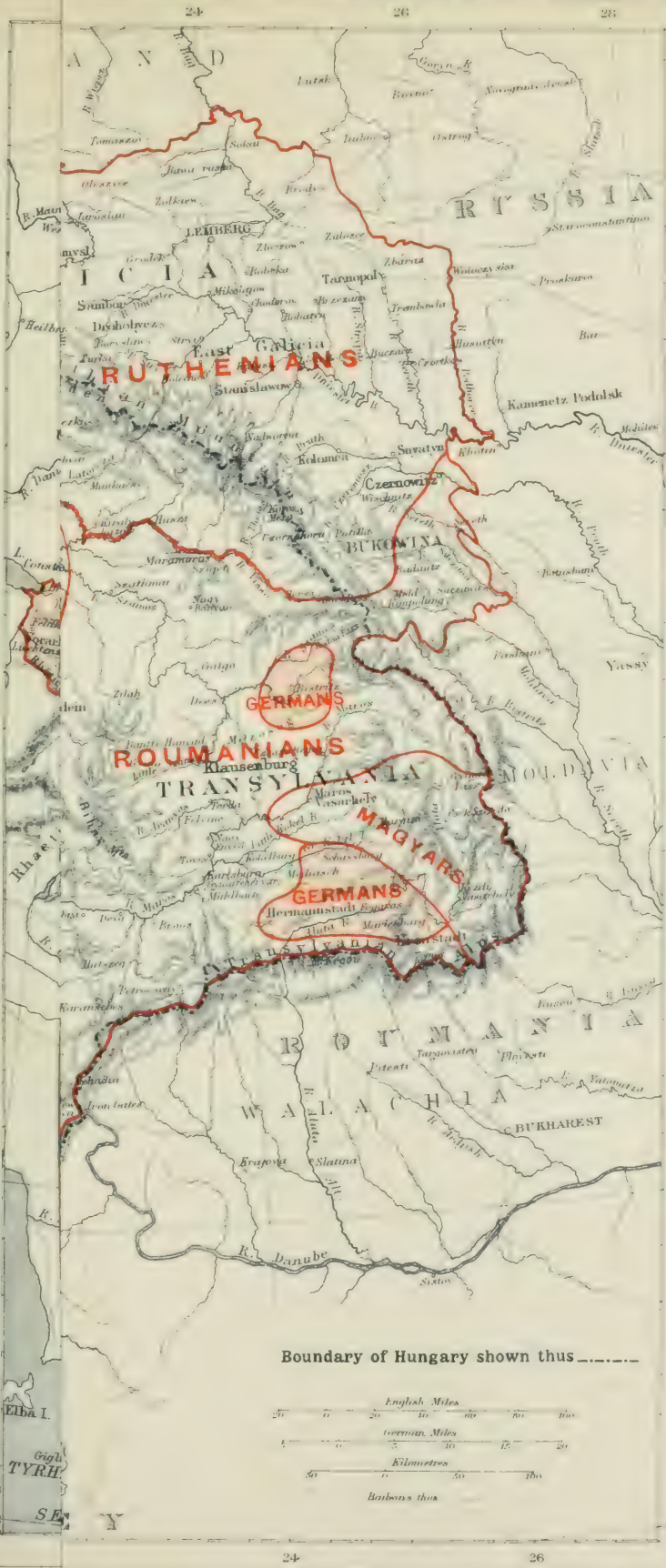
GENERAL.

ATLAS UNIVERSEL DE GÉOGRAPHIE. Commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Nr. 66, Afrique Française, feuille III.; Madagascar, 1 : 5,000,000. Price 2 francs each map.
Librairie Hachette et Cie., Paris.

L'ANNÉE CARTOGRAPHIQUE.—Quinzième Année. Dressé et rédigé sous la direction de F. Schrader. November 1905. Price 3 francs.
Librairie Hachette et Cie., Paris.

This useful annual shows the cartographic changes for the year 1904. It contains three folio plates giving a summary of the explorations, surveys, and new frontiers in Asia, Africa, and America.

TO ILLUSTRATE Mr RALPH RICHARDSON'S PAPER



MAP SHOWING THE RACES OCCUPYING AUSTRIA-HUNGARY

TO ILLUSTRATE Mr RALPH RICHARDSON'S PAPER

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE FÆRÖE ISLANDS.

By James Currie, M.A., F.R.S.E.

(With Illustrations.)

Far out in the wide Atlantic there rises a little group of islands, grass-covered, rock-margined, mist-shrouded. These are the Færöes. They have played no great part in the history of the world, and are still to a large extent outside the range of the influences that affect modern Europe. Indeed, to most people, and even to their Danish owners, they are little more than a name. And yet in this small archipelago, almost indistinguishable though it be on the map of the world, there is much to interest, much to instruct, and on a more intimate knowledge much to charm.

The position of the Færöes geographically will perhaps best be realised by saying that they lie due north of Stornoway, at the apex of an equilateral triangle whose base of about 180 miles stretches from that town to Lerwick in Shetland. Or their situation may be otherwise indicated if we imagine a line drawn straight from Edinburgh to Cape Wrath, and continued an equal distance further in the same direction. This gives a total distance of something like 330 miles, and brings us to the most southerly island of the group. The nearest land in any other direction is Norway to the east, and Iceland to the north-west.

The islands stand upon a submarine plateau, sloping somewhat gradually from 40 fathoms down to about 100, and then dropping rapidly to about 200 fathoms. Towards the south-east and north-west this depth is not exceeded, the bottom being prolonged into the submarine ridge that connects Scotland and Iceland; but to the north-east

at once and to the south-west beyond a projection towards Rockall, the sea-floor plunges to the profound depths of the Norwegian Sea and the North Atlantic.

A glance at the chart shows that the 50-metre (or say the 30-fathom) line follows the present coast contour pretty closely, so that the sea-bottom to this depth is more or less a continuation of the land slope, and an elevation to this extent would effect only minor changes. There would still be many separate islands, and their shore contours would be little different from the present. But with an elevation of about 60 fathoms, not only would all the islands coalesce into one, but nearly all trace of their sounds and fjords—still faintly discernible on the 100-metre line—would disappear. This line, then, may be taken as approximately marking the effective limit of subaerial denudation on the now submerged land, and its coast-line must of course have been somewhat lower.

The present greatest depth in the neighbourhood of the land appears to be 188 metres (103 fathoms), between Österö and Kalsö. Other depths of over 50 fathoms are to be found in about a dozen localities, mostly in narrow sounds or in the seaward continuations of the fjords, in fact just where such deeps might be expected to occur if they owe their origin in part at least to glacial action.

The Færöes consist of some score of islands, of which seventeen are inhabited, while the remainder only afford sustenance to a few sheep and harbourage to countless flocks of seafowl. The total area is 1325 square kilometres, or about 520 square miles, and may thus be conveniently compared with the trap area of Skye; that is, with the district north and west of Loch Brittle and Loch Sligachan. But the extreme limits from east to west and from north to south being nearly double those of this part of Skye, and the mountains being twice as high, the succession of rock disclosed in the Færöes is very much greater, and is estimated by Professor James Geikie at 14,000 feet, against the 2000 feet calculated by Harker for the Scottish island.

The name of the group has remained almost unchanged during its thousand years' history. It is Færeyir in the Sagas, Föröyer in the Færöe dialect, and Færöer in Danish. The word has been variously derived. Far Islands, Fare Islands, Feather Islands, have all been suggested; but the generally accepted derivation is from Fær or Faar, sheep; and, if the name is really of Scandinavian origin, this seems upon the whole to be the most probable. Already three hundred years ago Debes objected to this on the ground that Faar is not a Norse, but only a Danish word; but (if one may be permitted for a moment to invade the territory of the philologist) it appears not unlikely from the use of such terms as Færsauðr and Geitsauðr, that in the older "Donsk Tung," Sauðr may have been the generic name for "small cattle" in general, and that while in Danish it dropped out of use altogether, it became in Norse limited to sheep, and in the latter language therefore drove out the word Fær, which had thus become superfluous. We may perhaps see another development in the direction of specialisation in the present use of the word Faar in Danish to denote a ewe. Fær also does

occur, though rarely, in Norwegian place-names.[1] As so many guesses have been made at the origin of the name, there can be no great harm in suggesting another, and speculating whether it was not bestowed by its first inhabitants, the Irish anchorites, because of its rich grassy slopes, from the Gaelic *feur*, grass.

Very frequently the whole group is referred to collectively as Færöe, as if it were a single island. This mode of expression is of considerable antiquity, and is sometimes convenient. It is in exactly the same way that we often speak of Orkney instead of the Orkneys.

Lying as these islands do in the course of the Gulf Stream, or of the great north-east drift of the North Atlantic, and only a very short distance from the edge of the cold polar current that sweeps round the east coast of Iceland, the climate is in the highest degree variable and uncertain. But for the same reason the extremes are not great. The summers are cool and the winters mild. Thus the mean temperature at Thorshavn in January is about 37·8° F., and in July 51·4° F., while the absolute extremes in twenty-five years were 11·1° F. in winter, and 70·1° F. in summer.

The most marked effect of the moisture-laden winds which impinge upon the islands is the production of fog and cloud and a heavy precipitation.

Fog is most prevalent in summer. Thus at Thorshavn, where it occurs on the average upon fifty-one days in the year, twenty-nine of these are in June, July, and August. And this gives only a very incomplete idea of the occurrence in the islands as a whole, since very often some are densely covered while the sun is shining upon others.

Similarly, of course, it is the summer months which have the greatest number of cloudy days. But a clear day is rare at all seasons. Thus if we take a clear day to be one when not more than one-fifth of the sky is covered with cloud, there are at Thorshavn on the average only six clear days in the year.

While cloud and fog are commonest in summer, the greater proportion of the precipitation is in autumn and winter. The total annual rainfall at Thorshavn is about 64 inches, distributed over 279 days, and of this quantity about 40 inches fall in the six months from October to March.

A good deal of snow falls in winter and early in spring, but near the shore it rarely lies more than a week or so, and by the beginning of summer it has almost disappeared from the highest rifts and corries. Nevertheless, it sometimes lasts long enough to do a great deal of harm to the sheep, and in some localities it may gather on the slopes and cause avalanches. Thus the farm of Gjerdum in Bordö is said to have been three times destroyed in this way, and if local tradition is to be believed always upon the same day, March 12, although at intervals of a very great number of years. It has now been removed to another site, which although less convenient is safe.

There are three features in the Færöe landscape which must attract

[1] Cf. O. Rygh, *Norske Gaardnavne, Indledning*, p. 31.

the attention of the least observant, and which connect the conditions of situation and climate with the geological structure and history of the islands.

The first of these is the occurrence of the characteristic escarpments, which, sometimes as merely broken ground, sometimes as precipitous cliffs up to 100 feet in height, may be traced one above the other for miles along the hillsides. These are very correctly described by Landt, who wrote his account of Færöe at the end of the eighteenth

Fig. 1.—Stakken, Strömö.

century. He says that some of the mountains "slope smoothly down to the sea, but the most have two, three, four, or more so-called 'hammers,' which consist of a nearly horizontal layer of compact naked rock projecting from the hill or even overhanging, above which there is a slope covered with a little soil and with grassy sward—this slope being interrupted by another hammer, which in turn is again surmounted by a sloping ledge, and so on." He further notes how the hammers and ledges ("Lier" or "Brækker") upon one hill correspond with those upon a neighbouring elevation; and so striking does this seem to him, that, with a licence of speculation which at that date would probably have been frowned upon by his brother clergymen of Scotland, he suggests the query whether the hammers may not represent successive

levels at which the sea has stood. At the same time Landt was a very good observer, and he was quite aware that the hammers often depart from strict horizontality.

Almost equally striking in a view of the topography of Færöe is the occurrence everywhere, sometimes high up on the mountains, of valleys terminated by rounded ends. Such corries or cirques are known in Færöe as "Botnir." The hammers are continued round these valleys, and at the ends the higher ones successively retire, so that such valleys often mount by a series of broad steps, until they terminate against a precipitous wall. They are well described by Landt, by Forchhammer, and by Professor James Geikie.

In the formation of these corries in their present form glacial ice has no doubt played its part. But it is quite impossible to consider them attentively, without often recognising that so far as their major features are concerned, they belong to a period far anterior to the Glacial Era, that their form and direction were determined when the general topography of the country was very different from the present, and that many of them are the last remnants of valleys whose lower courses have long since disappeared.

Lastly, as a characteristic feature in the landscape we have the magnificent cliff-faces that in many places front the ocean. These are absent in the fjords, and are rarely conspicuous upon the eastern shores of the Færöes. But on their west coasts, which are exposed to the full strength of the Atlantic storms, the islands present for miles an almost unbroken front of mural cliff, rising often 1000 feet above the sea, and at Myling, where the greatest vertical elevation is attained, nearly double this height.

All over the islands a ceaseless waste is going on, to which every worn pinnacle, every mouldering hammer, and the long screes at every cliff foot, bear eloquent testimony. At Tofte near Andefjord, in the north of Österö, the farm had to be deserted because of the constant falls of stones from the mountain above, and at the end of the eighteenth century Kvannesund in Viderö was destroyed by a landslip. And on the coasts where subaerial and marine denudation proceed together, the effect is still more rapid and conspicuous. For example, the little islet south of Syderö, called Munken, was about 75 feet high when Landt wrote his description, but in the course of last century it was undermined by the waves, a large part of it fell down, and it is now only about half this height. Similarly, in describing Skuö, Landt incidentally mentions that falls of rock on the west coast of this island had much diminished the value of its Bird Cliffs.[1]

[1] *Beskrivelse over Færöerne*, p. 77. The passage is omitted in the English translation of 1810.

In warning to any archæologist who may find himself in Færöe, it is perhaps well to mention that in the immediately following passage, which describes the tomb of Sigmund Bresteson, "much defaced by the hand of time," but "covered with figures in bas-relief," the translator, usually pretty accurate, has allowed his imagination to run away with him altogether. Landt is here describing, not the grave (which he had apparently never seen), but some rocks on the shore which seemed to him to bear a fantastic resemblance to sculpture. The stone that marks the grave is not visible from the sea, and has only an incised cross formed of double lines.

To the visitor who sails along these shores in summer, the sea, though hardly ever still, seems to surge back sullenly from the impregnable ramparts that oppose it. Even then, no doubt, the silent work is going on, and the undercliff is being gradually cut away. But it must be far easier to realise the intensity of the battle when in winter the ocean flings itself against these precipices with so incredible a fury, that even the immediate issue of the fight seems doubtful, and the fate of Atlantis appears to impend over the devoted land. And though when the spring returns, and the sun shines fitfully again, not much appears changed, yet here and there the scar that marks a fresh fall of rock, a ledge swept away that gave the fowler foothold, the scalped and riven turf that protected the brow of the crag now staining acres of the rock face with a grey smear of mud, prove that in this secular conflict the powers of destruction have indeed gained another victory, which, although inconsiderable in itself, points to the inevitable end, so that these formidable bastions, which seem as though they might bid the sea defiance till the end of time, are already doomed to yield to it.

An illustration of the height to which the influence of the winter waves can attain is given by Debes, and on this occasion there seems no reason to doubt his narration. "The little island of Kolter," he says, "is exposed on the west side to the open sea, and towards this there is a steep promontory 30 fathoms high, where, with a western wind, the sea nearly every winter rushes over, and that to such an extent that the inhabitants are sometimes in danger. . . . It happened a few years ago that on the edge of this promontory there lay a large stone 6 feet long and 4 feet broad and high, which this proud sea overturned and cast several paces from the place where it formerly lay."

It is instructive to note how close the watershed often keeps to the west coast. Thus in Syderö the stream called Stóra rises at a point only half a kilometre from the west coast, and after a descent of 200 metres falls into the sea 4 kilometres to the east. Indeed, in many cases the western mountains are obviously cut back to their summits and beyond them. Snubbin, immediately to the south of Myling, rises to a height of 623 m. (2044 feet) within a horizontal distance of 180 m. from the sea, thus at an average angle of 74°, while on the other side it slopes down gently to the stream in the corrie at an angle of only 30°. The almost complete absence of fjords on the west coast points to the same conclusion. That is, the tableland has been so far cut back upon that side, that there are no valleys left there whose submerged lower courses could form fjords.

Often in the gradual retreat of the rock front a portion more resisting, or for some reason less exposed to attack, is left behind, either partially or wholly detached from the cliff. The most conspicuous example of the former is Troldkonefingeren on the south-east coast of Vaagö, which rises to a height of 1027 feet above the sea, the upper third of this height standing out free from the cliff. Of the wholly free stacks or "drangar," the highest is Bugvin, at the north-west point of Österö, 616 feet. Stakken, near Myling (fig. 1), is 435 feet, while Risen and Kællingen (fig. 2), which lie off the next headland to the north, are respectively 245 and 238 feet. And there are many others.

One of the most interesting of these localities is Toskaradrangar, on the west coast of Strömö. Here there is a chain of eight stacks extending along the shore for a distance of half a mile. These rise to a height of nearly 500 feet, while the cliff from which they are detached has a vertical elevation of fully 800 feet. Between them is a narrow channel sometimes not more than perhaps 20 feet wide at the sea-level. It is difficult to conceive anything more impressive than this rift, when on a summer evening the westering sun here and there sends a yellow blaze between the islets or through the colossal arch that pierces one of them, but only leaves in deeper gloom the chasm, with its almost overhanging walls and the deep mysterious caves that run far into the cliff.

It will have been gathered from the foregoing remarks that the Færöes are a mountainous group, and this is indeed the case. Only in places on the eastern coast and at the bottom of the valleys is any level ground to be found; unless one takes into account the lofty plateau, with an elevation of 1000 feet or more, from which the higher summits lift themselves, at least on the more southern islands. A rough census shows 390 summits above this height. The highest of all the peaks is Slattaratinde, in Österö, 882 m., or 2892 feet, but there are at any rate ten other peaks over 800 m.

As a rule the hills of the more northerly islands are the steepest and at the same time the loftiest. Kunö affords perhaps the most striking example of this, the island forming a long narrow ridge, which for about eight miles does not sink below 1800 feet, and which rises into a series of elevations, several of which exceed 2500 feet. These summits are in all cases within a mile of their base, and sometimes within little more than half this distance, so that the average slope from sea to summit is as much as 40°. I do not here refer to precipitous faces which have been cut back by the sea, and where of course the angle is often much greater, but to the green slopes that descend to the comparatively sheltered waters of Harald-Sund.

It might be expected from the fact that they are composed of nearly horizontal beds, that the mountains would be all flat-topped. But when one scans a wide landscape it is obvious that most of the hills terminate in peaks or sharp edges (fig. 3). Forchhammer contrasts these serrated summits with the rounded hills of Orkney and Shetland, and suggests that even the Scottish trap islands must consist of a different rock, since they "bear little resemblance to these extraordinarily sharp and jagged outlines." It seems probable all the same that what difference there is in aspect between the Færöes and the trap area of the Hebrides is due less to any difference in the rock than to the more exposed situation and greater height of the former islands.

A very characteristic feature of the mountains of Færöe is the frequency with which they assume the forms of trigonal or quadrangular pyramids. This is seen quite plainly in the case of Slattaratinde itself above the 700 m. contour line, but even more distinctly in the range of hills immediately south of this, where Vaðhorn and Husafjeld are three-sided pyramids, and the hill between them a four-sided one. Often, as in this last case, the contours of the sides are actually more or

less concave instead of being convex. Other well-marked instances are Skællingfjeld in Strömö and Malinsfjeld in Viderö. But the phenomenon is seen on the largest scale in the case of the Færöe group itself, which, even as it now appears above the sea-level, but still more if we take the 50 or 100 fathom line, shows itself as the triangular top of an

Fig. 2.—Kællingen, Österö.

elevation whose base is deep below the ocean. Sometimes an obvious explanation is the consideration that the point of junction of two ridges is stronger to resist denudation than the ridges themselves, and that a relative elevation will therefore tend to come into existence, with three or four corners according to whether the second ridge merely joins the first or actually crosses it. But this explanation certainly does not suffice in all cases, and hills with straight or concave sides and sharp

edges running down from the summit, are seen where there is no indication of any ridge at all.

As might be gathered from the nature of the surface and the way in which the islands are cut up by fjords, there are no important streams. The largest are not more than about five miles long, and there is but little water in them, except immediately after heavy rain, when for a short time they may be so full and so tumultuous as to be dangerous.

Of lakes there is one large one, Sörvaagsvatn, 6 kilometres, or $3\frac{3}{4}$ miles long, two or three others over a mile in length, and a number of smaller lakes and tarns. But these are by no means actually characteristic of Færöe scenery, and they are often lacking in corries where the climber from below makes sure of finding them. Perhaps this is in part due to the rapid waste of the hills having silted them up. They are either in rock-basins, as Sörvaagsvatn, whose waters after a course of a few yards precipitate themselves into the sea over a cliff 90 feet high, or they are separated from the sea by alluvial barriers or sand dunes, as Sandsvatn.

From their geographical situation, and the nature of the narrow sounds that intersect them, the Færöes are exposed to very violent tidal currents. The range of the tides is not very great, being indeed at the most only some 8 feet on the west side of the islands, and 6 feet on the east. This rise and fall of the tides is of little importance to the inhabitants; but, dependent as they often are upon the sea for their communication with the world outside their own village, they rely much upon a wonderfully minute and accurate knowledge of the currents. It may suffice to say here that the main stream caused by the flood flows to the west, and is called the Westfall,[1] while the stream caused by the ebb flows towards the east, and is called the Eastfall. After the main stream has commenced to run through a sound, eddies begin to form in the lee of all the projecting points, and as the end of the flood or ebb approaches, these eddies slacken like the main stream, but at the same time broaden out and gradually take its place, while new eddies form on the reverse side of the projections and run, of course, in the opposite direction. The speed of the currents varies very much. At their strongest in the very narrow sounds and immediately off sharp headlands, they may attain a velocity of nearly 10 knots, while in the open sea 3 knots is about the maximum.[2]

Geologically the whole of the islands, with the exception of the superficial deposits, consist of igneous rock, alternating everywhere with thinner layers of tuffs and the red and green clays that mark old land surfaces, and in Syderö, Tindholm, and Myggenæs, with beds of lignite and coal. It is difficult to make out any definite lithological progression, and the lavas are all more or less porphyritic, and more or less amygdaloidal. Agglomerates are not common, but Forchhammer mentions the occurrence of one in Viderö, Professor Geikie records another at Kvalbö in Syderö, and there are considerable masses in Tindholm

[1] Cf. Shetland. Lantfael, the flood tide (Edmonston, *Gloss. Shetl. Dial.*).

[2] *Den Færöske Lods*, p. 6.

and near Fuglefjord. Further, the older rocks are penetrated by numerous sills, and these being as a rule harder than the dolerites between which they intrude, stand out along the hillsides to form the hammers already referred to. But among the earlier bedded rocks themselves there are marked differences in texture and hardness, and in the consequent liability to disintegration: so that although practically every sill becomes under certain conditions a hammer, it is far from being safe to conclude that every hammer represents a sill. Landt observes that the hammers are least frequent in Syderö; and since the rocks in this island are the oldest in the group, we may have here an analogy with Harker's observation in Skye, that "the sills become more numerous as we ascend in the succession."[1]

Dikes, usually basaltic, are very common, and by their disintegration are sometimes a conspicuous feature in the landscape, forming on the coasts deep gios and caves, and upon the mountains precipitous ravines, which may sometimes be traced across the fjords, or even from one island to another. The connection, if any, between these dikes and the bedded rocks has not been made out, and no trace has been observed of the vents from which the lavas were poured; but on the cliff on the south-west of Strömö, Sir Archibald Geikie's practised eye detected an interesting little group of volcanic vents, from which ash and stones had been ejected. By the cutting away of the cliff these are now seen in section, and the crater-like form is easily distinguishable.

The coal deposits are mainly developed in the island of Syderö. They have been worked intermittently for the last two hundred years, and some of the coal looks good, and has given a favourable analysis. But probably, like many other mines, these have taken more money in than they have ever given out.

Unfortunately, the clays in connection with the coals do not afford any recognisable plant remains; but there can be no doubt that the rocks are of Tertiary age. At the same time there is no sufficient ground for definitely assigning them, as has been somewhat hastily done, to the Miocene period; and several considerations point to an earlier division of Tertiary time. It is not, however, necessary to assume that they are exactly contemporaneous with the igneous rocks of Ireland and the Hebrides.

Except where the slopes are too steep, the ground is covered with alluvial deposits. These consist to a slight extent of boulder clay and moraine material, and much more largely of peat and a soil derived directly from the decomposition of the underlying rocks. This nowhere attains any considerable depth.

All the islands are very much glaciated. Striæ are visible in many places, and the larger features of glacial action, *roches moutonnées* and smoothed rock surfaces, are to be discerned everywhere, up to a height in Strömö of about 500 metres, or say 1650 feet. In Syderö Professor Geikie found ice-markings up to 1400 feet, and he was of opinion that

[1] *The Tertiary Igneous Rocks of Skye*, p. 241.

the ice of that island was connected with the *mer de glace* of the northern islands. This view has not, however, received universal assent.

The easily-weathered igneous rocks are not suited for the preservation of the characteristic effects of ice action; and the course of the present obliterative processes could not be better described than it is by Professor Geikie in his paper on the Geology of the Færöe Islands. "Throughout all the islands," he says, "the features impressed by former intense glacial erosion are now . . . being more or less rapidly effaced. *Roches moutonnées* are breaking up and disappearing; ice-worn cliffs are being chipped and shattered by frost; great taluses of débris are accumulating at the foot of scaur and precipice; rock-basins are being tapped and silted up; streams are digging deep gullies in the flat glaciated bottoms of cirques and valleys; and thus ere long the characteristic ice-worn outlines will vanish, and those features which must have characterised the islands in early pre-glacial times will come more and more prominently into view."[1]

I must confess that my own visits to the Færöes impressed upon me the conviction that the Glacial Period was a mere incident in their recent geological history, that it had comparatively little influence upon their main topographical features, and that its principal result must be looked for in the removal of the immense protecting masses of disintegrated rock which had accumulated upon the surface of the land in the gradual course of ages and its consequent renewed exposure to a more rapid and severe denudation.

I shall not refer here in any detail to the mineralogical wealth of the Færöes. It is now more than a century since they first became celebrated for their Chalcedonies and Opals, and a little later for the Zeolites with which they have adorned the museums and private cabinets of Europe. The group has been explored, or at least visited, by several competent mineralogists. Probably about the earliest was the well-known traveller in Greenland, Sir Charles Giesecke, and he was followed by Count Vargas Bedemar, my fellow-townsman Thomas Allan, G. Forchhammer, M. F. Heddle, and A. des Cloizeaux. But much still remains to be observed and much to be described. Indeed a certain fatality appears to attach to mineralogical descriptions of Færöe. Giesecke spent a whole winter in arranging the results of a summer's tour among the islands, and his manuscript was destroyed in the bombardment of Copenhagen by the British fleet; Count Vargas Bedemar, who spent several months on the islands, has left us one paper on the Opals; Forchhammer promised an account of the minerals, but died without ever writing it; and finally all the knowledge accumulated by Heddle in two long visits is represented by a posthumous paper of a dozen pages. It is fortunate that geognostic descriptions of Færöe are free from this fatality, as witness the excellent papers of Forchhammer and Professor James Geikie.

Among the minerals that occur in the rock masses, as distinguished from those that are found in the steam cavities, the most important is Labradorite, which occurs porphyritically in nearly every lava-flow,

[1] *Trans. Royal Soc. Edin.*, xxx. (1880), 260.

sometimes very minute, and sometimes, on the other hand, in crystals an inch across. Another interesting mineral is native copper, not infrequent at some localities. An attempt was made at one time to utilise the rock at Nolsö as an ore, but the metal occurs in such insignificant quantities that the project never got further than the smelting of a few hundredweights of stone.

Fig. 3.—Kamburenni, Fugletjord.

But it is for the minerals which have crystallised out into the steam cavities of the amygdaloids, and which are thus all of secondary origin, that the Færöes have so long been celebrated. Such cavities reach in these islands a quite unusual size, being occasionally several feet in diameter. Professor Heddle mentions a druse at Tjörnevig in Strömö "some 9 or 10 feet in length, by about 2 in width and 1 in depth";

and near Troldkonefingeren in Vaagö I was unable, with an 8-foot boat-hook, pushed in at arm's-length, to reach the end of a narrow irregular cavity lined with Stilbite. On the other hand the steam cavities may be very minute and extraordinarily numerous. Thus at Strömnæs, near Kvalvig, I estimate that there are sometimes over 200 to the cubic centimetre. Whatever their size, the contents of the cavities may be either one of the amorphous hydrated Silicates derived from the break-up of the Pyroxene of the dolerite, generally Celadonite; or they may be one of the forms of Silica; or they may be one or more of the Zeolites.

If the geode is filled with silica, this takes the form of either Chalcedony or Opal, or of both of them together, in alternating horizontal bands, in which case they constitute the characteristic Onyx of Færöe. Opals are very common. They are generally milk-white, but often yellow or brown, and sometimes red, green, or blue. They are of little or no value for jewellery, for they very seldom show any play of colours, though Count Vargas Bedemar describes one from Odnadalstinde "with all the colours of the rainbow." The finest Chalcedonies have been obtained from near Lambavig in Österö, where, according to Allan, they occur in plates up to 4 feet by 2. The Opal-Onyx has been already mentioned. The best specimens occur near Kvalvig, and inferior examples are found in many localities. True Agates, on the other hand, are very rare.

The flora of the islands[1] differs little from that of the neighbouring lands, except in the relative poverty of the species, and none of the phanerogams is endemic. Thus of 253 native phanerogams not more than ten are not also found in Great Britain.[2] Of these the most likely to attract the attention of a visitor are a pretty little alpine Buttercup, *Ranunculus glacialis*, L., *Archangelica officinalis*, Hoffm., and, on the mountains of the Northern islands, the Iceland Poppy, *Papaver radicatum*, Rottb. There are also several species, mainly of an Arctic type, which are common in Færöe, but more or less rare in Britain, except sometimes on the highest hills. Such are *Cerastium Edmonstonii*, Wats., *Oxyria digyna*, (L.) Campd., *Saxifraga stellaris*, L., *Thalictrum alpinum*, L., and, perhaps most conspicuous of all, *Silene acaulis*, L., which everywhere in Færöe, from the sea-level to the mountain-tops, stands out with its cushions of pink blossoms in vivid contrast to the grey rocks among which it flourishes.

Of phanerogams not also found in Scandinavia there are only seven, none of them being very important. But there are several Atlantic species very rare in Norway and exceedingly abundant in Færöe, such as *Lychnis flos cuculi*, L., and the common daisy, *Bellis perennis*, L.

If we turn to the remaining neighbour-land, Iceland, the number of Færöese species not common to both rises to fifty-eight, and these

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[1] Cf. Ostenfeld, *Botany of the Færöes*, i. 100.

[2] These figures do not include the variable genus *Hieracium*, of which there are twenty-one species—all, according to Dahlstedt, endemic.—*L.c.*, ii. 625.

comprise such fairly abundant Færöese plants as *Narthecium ossifragum*, L. (Huds.), *Potentilla tormentilla*, Scop., *Hypericum pulchrum*, L., *Polygala serpyllacea*, Weihe, and *Erica cinerea*, L. On the other hand, the occurrence in both Færöe and Iceland of *Alchemilla fœroënsis* (Lge.), Buser, and *Carex cryptocarpa*, C. A. Meyer, which are not found elsewhere in Europe, indicates a certain connection between these two countries.[1]

As has been pointed out by various observers, the botany of the Færöes has been profoundly modified by human action. To man is due the almost complete disappearance of the Juniper from the landscape; while indirectly, by the introduction of sheep, he has probably exterminated some species, has certainly rendered others very rare, and has undoubtedly, in any case, very much limited the range of many, and thus contributed to the somewhat monotonous aspect of the hillsides. This fact is impressively borne in upon the botanist who lands in any gio or upon any bank inaccessible to the sheep. It is impossible, in such circumstances, not to be struck by the difference and relative richness of the vegetation.

There are no vertebrate animals endemic to the group, and the few land mammals are all immigrants. Apart from domestic animals there are only rats, mice, and hares (*Lepus timidus*). The last were introduced about thirty years ago, and in some districts are now not uncommon on the mountains.

More important than the wild animals of the land are the sea mammals—walruses, seals, and whales. The first are only very rare visitors; and the second, of which several species were formerly abundant, are now almost exterminated. They used to breed in large numbers in the almost inaccessible caves along the coast, as many as fifty being sometimes obtained from one cave. Seal-catching was an important Færöese industry during the eighteenth century, but now not more than two or three are shot in a year. In the course of a three weeks' cruise in 1905 not a single individual was seen.

Whales have been long a source of wealth to the islands, and up to the present day the Ca'ing or Bottlenosed whales (*Delphinus globiceps*)—"Grindehvaler," as they are called in the Færöes—are hunted in the manner described by Scott in *The Pirate*. Of late years several whaling stations have been established in Færöe, but the whalers do not trouble themselves about the Grindehvaler, which are only from fifteen to twenty feet long. They seek principally the larger species of whales; and the industry is said to have been tolerably profitable both to the shareholders and to the islands, although the immediate neighbourhood of a station—at least of the old-fashioned kind—is not exactly agreeable. In the newer stations the unpleasantness of decaying flesh is altogether avoided, for there the whole carcase is used up in one way or another, and the boiling takes place in hermetically-sealed retorts.

After all, however, the sea animals are but occasional visitors, and the real interest of Færöe to the naturalist is due to its birds.

The avifauna is not remarkably rich in species. It indeed comprises

[1] Ostenfeld, *l.c.*, i. 109.

altogether only some 140 different birds, and there are only about a score that can be described as common. But of these some occur in incredible numbers.

As might be expected from the small area of the islands, their high latitude, the remoteness of their situation, and the total absence of trees or even bushes (save in a few gardens), the singing birds—thrushes, finches, and warblers—are conspicuous by their absence. So also is the entire falcon family. The erne has vanished, although the names of various places like Örnefjeld in Syderö bear testimony to its former occurrence. The only hawk that now breeds in the archipelago is the merlin—Smiril in Færöese—and this is very rare. The birds of prey are represented now by the raven and hooded crow, both of which are to be seen everywhere. It is not at all uncommon to find white or pied ravens, and according to Debes these are more easily taught to speak than the black ones. The more common of the remaining land birds are Snipe, Golden Plover, Whimbrel, and Oystercatcher, and especially the two last. The Oystercatcher, called in Færöe Tjaldur,[1] demands a word or two, because it has been adopted as the national emblem of the small community, in whose estimation it has always occupied a high position because of the service it renders to the shepherd by the zeal with which it drives away the raven from his flocks.

But of more importance to the islanders than any of these birds are the sea-fowl. Long before the first colonist arrived the cliffs swarmed with birds. Writing in 1670, Debes says that "they are so numerous as to be uncountable, and they fly out from the cliffs in such multitudes that in clear weather they can obscure the sunlight like thick clouds, and so loud is the rush and noise of their flight that any one who did not know the cause would think it thunder." Such, allowing for a little poetic imagination, was the cliff life of Færöe two and a half centuries ago, and such is it in many places still.

The principal occupants of the cliffs are Puffins, Guillemots, Razorbills, Kittiwakes, and Solans. Others of less consequence are Shearwaters, Terns, Skuas, various species of Gulls, and the Fulmar. The last-named is the latest immigrant to the islands. In 1800 Landt described the bird as "known only to those who fish far out from land," but forty years later it began to breed in Syderö, and it is now common in several localities.

The Gannet or Solan breeds in one locality only, the little holm to the west of the island of Myggenæs. It is difficult to say what determines the choice of a breeding-place by birds. Many apparently excellent localities are without a single inhabitant, while in others the birds sit so close on every available ledge that they have not room to move. And of all the birds the Solan seems in Færöe, as elsewhere, to be about the most particular. Along the many miles of that rocky coast, Myggenæs Holm is the only spot that pleases him. Thither he resorts at the beginning of every year, and there he has nested in his thousands from time immemorial.

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[1] In Shetland *Scholder* (Edmonston, *Gloss. Shetl. Dial.*).

The fish of Færöe are the ordinary species of the North Atlantic, with trout, char, and eels in the streams and lakes. Of the other members of the animal kingdom it is enough here to say that there are no reptiles, and few land shells, and that of insects about a hundred species of beetles, a few moths, and one species of butterfly only have been recorded. In three weeks of June last year, most of which was bright and clear, the writer saw only a single butterfly.

(*To be continued.*)

THE SCULPTURE OF MOUNTAINS BY GLACIERS.[1]

By Professor W. M. Davis, of Harvard University.

(*With Illustrations.*)

The present condition of the problem of glacial erosion.—The problem of glacial erosion in mountains has in recent years been carried many steps towards its solution by means of a series of studies in which the forms of formerly glaciated and of never glaciated mountains have been systematically compared. It has thus come to be believed by a number of observers that the glacial erosion of piedmont lake basins must be extended to the over-deepening of the main mountain valleys far upstream from the lakes, and that the retrogressive glacial erosion of cirques carries with it the sapping and sharpening of the culminating ridges and peaks. The last-named effect is truly not the direct work of ice, but it is so closely dependent upon glacial erosion that it should be included in any discussion of the sculpture of mountains by glacial agencies; just as the wearing of slopes and ridges by the weather goes with the erosion of valley bottoms by rivers.

The observations and discussions that have led to a belief in strong glacial erosion are to be found in many different essays. Some of the earlier essays were based on almost intuitive insight; as when Ramsay was led to advocate the glacial erosion of lake basins, Gastaldi to accept the glacial erosion of cirques, and Helland to announce the glacial erosion of fiords. Many of the later essays are more surely founded on comparative studies, such as those on over-deepened valleys in the Cascade mountains of Washington by Gannett and in the Alps by Penck; on the fiords of Alaska by Gilbert and of New Zealand by Andrews; on the cirques of the Sierra Nevada of California by Johnson, of the Carpathians by de Martonne, and of the Big Horns by Matthes; and on the sharpened peaks of the Alps by Richter, and of Skye by Harker. There has thus been a great growth in the number of facts to be explained and a notable advance in the methods by which explanation is reached. It seems no exaggeration to say, in view of all this progress, that the sculpture of mountains by glaciers has been given that degree of extreme probability which we may fairly call demonstration. It should not, however, be

[1] Presented in abstract before Sections C and E (joint session) of the British Association at Cape Town, August 17, 1905.

overlooked that certain investigators still remain unconvinced, notably Heim and Kilian in the Alps, Bonney and Garwood in England, and Spencer and Fairchild in the United States.

Method of discussion here adopted.—Most of those above named as believing in strong glacial erosion have not been led to their belief by an intimate study of the physics of glaciers or of the mechanics of glacial erosion, but by a study of the unlike forms that characterise glaciated and non-glaciated mountains, as has already been stated. Their line of thought seems to be essentially as follows :—"It is difficult to determine whether the ancient glaciers did or did not significantly modify the mountains that they occupied, as long as we study only the structure and movement of existing glaciers. Let us therefore adopt another method. We will make two contrasted suppositions: glaciers cannot erode, and glaciers can erode; we will consider the appropriate consequences of each supposition separately; we will next confront these consequences with the facts of observation; and then, according as one or the other group of consequences is verified by the facts, we shall be able to determine impartially which one of the suppositions is correct."

In such a problem as this, it is evident that if glaciers cannot erode we ought not to find any significant differences between the forms of glaciated and of non-glaciated mountains; but if glaciers can erode we ought to find in glaciated mountains a whole series of peculiar forms, and these forms ought to be appropriately related to the form and movement of glaciers. The essential steps in the application of this method may now be outlined.

The forms of normally sculptured mountains.—The forms of non-glaciated, normally sculptured mountains are well known to exemplify Playfair's law as to the accordant junction of lateral and main streams and valleys. In mountains which have reached a submature or a mature stage of normal carving, and in which lakes are therefore drained away and waterfalls are worn down to grade, except in small headwater streams, the law of decreasing slope from stream head to stream mouth will also obtain; and then the accordance that has been earlier developed at the junctions of main and side streams will be found to prevail even at the junctions of the innumerable headwater branches into which river systems are divided; and as each little headstream is followed up to its source, its steepening slope will be prolonged up the still steeper waste-covered slopes in the head and sides of the ravines which ascend to the mountain crests; but over the crests themselves there will be a decreasing convex slope. Examples of these normal forms which have come under my own observation are parts of the Apennines in northern Italy, the Cevennes in south-eastern France, the Black mountains of North Carolina, some of the lower ranges in the Rocky mountains and farther west, and certain non-glaciated members of the Tian Shan system: to these might be added the outer ranges of the Himalayas at Simla, and certain ranges in the Argentine Republic, except that, when these examples were seen, my attention had not been especially awakened to the points here considered. The perfection of stream organisation thus exhibited, with its delicate interdependence of parts, should be regarded as one of the

strongest witnesses to the truth of the principles of rational uniformitarianism.

An important extension of Playfair's law concerns the relation of stream channels to each other and to the valleys in whose floors they are eroded. The channels occupy a very small part of the cross-section of the valleys, because water is a nimble fluid and its streams flow quickly in comparatively slender courses: furthermore, the very fact that the stream surfaces and the valley floors that border them meet in accordant level at the points of stream and valley junction necessitates the discordant junction of the channel beds whenever the confluent streams are of different size. The discordant junction of channel beds is not a conspicuous fact, because the streams in the comfortable climates of the older civilised countries usually fill their channels and hide their beds from immediate observation; but it is nevertheless a well-assured fact and a very important element in the present discussion.

Deductions from theories.—Now if glaciers have no erosive power, then maturely dissected mountains that have been glaciated should present no features significantly unlike those above described for mature non-glaciated mountains. But if glaciers have strong erosive power, special and significant features should be found in mountains where glaciers have had time enough to do their work. The most notable features of this kind that one would expect to find may be stated as follows:—A large part of the cross-section of a glaciated valley would be included in the trough-like channel that was scoured out and occupied by the heavy, sluggish glacier; the bed of such a trough would have rock steps and rock basins similar to those in the bed of a river channel, but appropriately of much greater size; the sides or walls of such a trough would be comparatively even and parallel, like the sides or banks of a river channel; the troughs of small side glaciers would necessarily be of much less depth than the troughs of large trunk glaciers, and hence the bed of a side trough would hang hundreds of feet over the bed of the trunk trough; the valley sides above the trough would, in mountains of mature sculpture, be less steep than the trough walls themselves; the heads of the glacial beds would be broad-floored cirques, because the heads of glaciers are broad and leaf-like instead of being divided minutely like the headwater streams of rivers; the summits and ridges between cirques which head near each other would be sharpened into peaks and arêtes by atmospheric weathering, induced by the retrogressive glacial erosion of the ice in the cirques, and by the glacial widening of the troughs. Other features might be named, appropriate to glaciers of large or small size, or of short or long duration; but those here set forth are sufficient for a brief exposition.

Graphic illustrations of glacial sculpture.—The attempt is made in Figures 1, 2, and 3 to present examples of the unlike features just described. The figures make no pretence of being drawn from actual mountains; but they are in a way made up from various observations, sketches, and photographs, and in this respect correspond to the "deduced consequences" of the hypothesis that glaciers can erode, as announced in the preceding paragraph; for the consequences are not

simply abstract deductions; they have been tested at nearly every step by observation. The figures undoubtedly need many amendments: they are hard and crude; yet they have some value in making the preceding paragraph clearer than it would be without them. Moreover, the figures ambitiously attempt to exhibit the changes that a given mountain mass would suffer from a preglacial time of normal sculpture, through a pronounced glacial period, to a postglacial time in which the work of the glacial period has as yet been but little affected by the return of normal conditions: in this respect they are necessarily only ideal examples.

Figure 1 shows the rounded, dome-like forms of a subdued mountain mass. The cliffs and ledges of an earlier stage of normal erosion have been worn away, and the waste cover has been very generally extended over the graded slopes that now reach from valley bottom to mountain top. This stage of mountain sculpture was chosen because it is so well represented in the Sawatch range of the Rocky mountains in Colorado in association with glacially sculptured forms, such as are illustrated in the later figures. Normally sculptured mountains of sharper form, like those of southern California, might have been taken had I seen them otherwise than in photographs. The main valley is widely opened; its floor is well graded to a continuous slope; its stream has no lakes or falls, but swings smoothly along a somewhat sinuous course between the spurs that come down with moderate slope from the higher ridges. The side valleys branch in a delicate fashion upwards, splitting the spurs into many spurlets; but all the streams and valley floors unite in accordant fashion at their many points of junction. The spurs are round-shouldered forms, exhibiting very few outlines by which their elusive curves may be represented: indeed, as here drawn, they have an undue resemblance to the sprawling feet of some huge pachyderm. I believe that, if mountains of this kind had been more familiar to those who have discussed the question of glacial sculpture in the Alps, a closer approach to agreement on the question of glacial erosion might have been reached ere now.

Figure 2 is intended to represent the accomplished work of a heavy glacial system on the mountain mass of Figure 1. The main glacier has gained room for its broad current by wearing off the ends of the spurs that formerly entered the main valley from either side: and it has gained room for its heavy and deep ice body by excavating the valley floor to a greater depth than it had in preglacial time. The side glacier which enters from the upper left corner of the figure is manifestly less deep than the main glacier; hence, while the ice surfaces of the main and side ice-streams unite at accordant grade, the beds of their troughs or channels cannot unite in that even fashion: for when the troughs are once scoured out to a satisfactory depth for the two unequal ice streams, further change of trough depth will be small. The smaller branch glaciers in the main mountain mass have enlarged the branch valleys that they occupy, and retrogressive erosion at the heads of these glaciers has transformed the tapering valley heads of preglacial time into blunt-headed cirques. The slopes of the spurs and summits have been greatly steepened and the ridges and peaks greatly sharpened by the active weathering resulting from glacial undercutting in the branch troughs

and cirques. On the extreme right another mountain is shown in which two cirques have been excavated, not of sufficient size to transform the preglacial dome into a sharpened peak, yet large enough to have encroached on the spur that separated them, and thus to have transformed part of it into a serrate ridge. Mount Elbert, the highest summit of the Rocky mountains within the United States, presents just this sort of a contrast to its slightly lower neighbour, La Plata peak, whose summit has been sharpened into Alpine form. If the glacial con-

Fig. 1.—A normally eroded mountain mass, not affected by glacial erosion.

ditions here pictured should last long enough, it is not to be doubted that the mountains would be in time reduced to lower and gentler forms than are here presented in the toothed peaks and serrated spurs of the central mass; and eventually they might be worn down so low that the glaciers would slowly and spontaneously disappear in consequence of the increasing mildness of climate thus produced—such being Tyndall's suggestion for the Alps; but the very fact that strongly glaciated forms, with the associated peaks and arêtes, now characterise the ranges that were heavily glaciated in Pleistocene time, suffices to prove that the glaciers did not disappear because of their own action in wearing down the mountains, but because of some external control of climatic change.

Figure 3 illustrates the appearance of the mountains and valleys after the glaciers of Figure 2 have melted away. Now there is a superabundance of detail; the difficulty in drawing is to select the most significant outlines and to omit the rest. The forms that rose above the ice streams in Figure 2 are here reproduced without essential change. The spurs on the left are unaltered in form, but are somewhat worn down from their appearance in Figure 1. The forms that were buried under the ice streams of Figure 2 are here disclosed to the light of day.

FIG. 2.—The same mountain mass as in Fig. 1, strongly affected by glaciers which still occupy its valleys.

The troughs of the smaller branch glaciers have ungraded floors, on which rock basins and rock steps alternate. The troughs of the large side glacier and of the main glacier are better smoothed. Alluvial fans are already accumulating on their sides, just as they are in the Alps and in other glaciated ranges. The fact of such accumulation suffices to prove a strong change from the conditions under which the troughs were excavated to the conditions in which they are now being filled up. The truncated spur-ends now continue downwards in the over-steepened trough sides, and curve at the base into the U-shaped trough floor. The junctions of the various glacial troughs—to which the name of valleys is

of course ordinarily applied—are essentially discordant. The trough of the large side glacier hangs high above the floor of the main glacier trough; the troughs of the smaller branch glaciers hang over the trough of the large side glacier. If the main trough could be followed down to its end, a large basin should be shown, occupied by a lake, and enclosed by morainic walls. As time progresses, all these peculiar features will be changed to normal features: a beginning of such changes is seen in the little slits by which the mouths of the hanging valleys are already beginning to be cut down; in the filling of the lakelets in the rock basins of the smaller branch troughs; and in the rapid wasting of the sharpened ridges and peaks, by which they will be in time rounded again; but the small amount of work thus far accomplished proves that the time since the evacuation of the district by its glaciers is comparatively short.

It is manifest that if a vigorous glacial system should soon again come to occupy the mountainous area of Figure 3, it would produce relatively small changes compared to those by which the forms of Figure 1 have been altered to those of Figures 2 and 3; for the glacier system of the second epoch would find the valley-troughs so well adapted to its needs that there would be relatively small necessity of modifying them. The amount of sculpture effected in a first glacial epoch may therefore be reasonably estimated as of much greater volume than in a second glacial epoch.

Consequences of theories confronted with facts.—When glaciated mountains are visited with the unlike consequences of the contrasted supposition above stated in mind, there can be little doubt whether glaciers are effective eroding agents or not. As far as the glaciated mountains of the world have been explored, it is found that they possess a large number of peculiar forms, which differ most strikingly from the forms due to the normal processes of erosion; it is further found that these peculiar forms are distributed with respect to one another in a most systematic and significant manner; and it is finally perceived that the peculiar forms are essentially similar to those above described and figured as producible by glaciers, under the supposition that glaciers have effective erosive power and that they have had time to use it. Thus the efficiency of glaciers in carving glaciated mountains is demonstrated by essentially the same method that has so thoroughly demonstrated the efficiency of the normal erosive agencies in carving non-glaciated mountains.

It can hardly be questioned that if, as Andrews has well pointed out, students of mountains had not come upon glaciated forms until after they had seen a good variety of normal forms, the exceptional quality of the needle peaks and the serrated ridges, of the rock basins and the rock steps, of the truncated spur-ends and the over-steepened trough walls, of the hanging side valleys and the over-deepened main valleys, would have been sooner appreciated. But, as a matter of fact, the Alps and other strongly glaciated ranges have been taken as types of mountain form from a time when there was no question at all of glacial erosion; and as a consequence the exceptional quality of many

Alpine forms has passed relatively unnoticed. The literature of the subject shows that the peculiar features which characterise glaciated mountains are not regarded as exceptional by observers whose experience has been gained chiefly in mountains like the Alps; yet, on the other hand, the peculiar features of glaciated mountains are very impressive when they are seen by one whose standard of normal mountain form has been established in non-glaciated mountains, and still more so when they are considered in view of the reasonable consequences of the

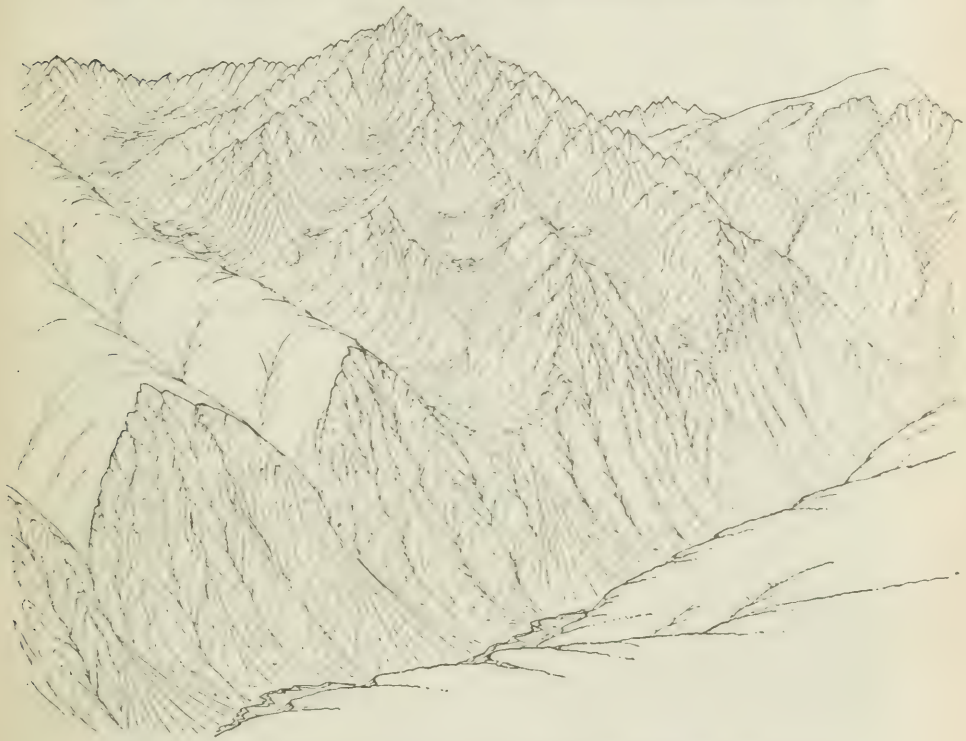

FIG. 3.—The same mountain mass as in Fig. 2, shortly after the glaciers have melted from its valleys

supposition that glaciers can erode their valleys or can modify pre-existent normal valleys.

Examples of glaciated mountains known to me from my own experience to possess the peculiar features above-mentioned are:—the Highlands of Scotland, where hanging cirques (corries), trough valleys, and valley-floor lakes abound; the Alps, where all of the characteristic forms of glaciated mountains are strongly developed; Norway, where the relation of hanging lateral valleys and over-deepened main valleys is persistent and convincing; various ranges of the Rocky mountains in the United States, where the contrast of glaciated and non-glaciated forms is very striking; and some of the higher ranges in the Tian Shan.

In several of these ranges the sharpness of the peaks and arêtes between neighbouring cirques is in strong contrast to the more rounded summits where cirques are farther apart or absent. When we note the significant variation in the size of these glacial features from the isolated small cirques, such as Partsch has described in the low mountains of central Germany, to the great confluent cirques and deep trough-valleys of the high Sierra Nevada as described by Lawson; when we recall their world-wide distribution, from the great fiord systems of Alaska as set forth by Gilbert, to the only less impressive fiords of New Zealand as pictured by Andrews; and when we note the systematic relations of their several elements, as has been so fully presented for the various glacial systems of the Alps in the masterful monograph by Penck and Brückner, now approaching completion, the trustworthiness of these unanimous witnesses to glacial erosion is unimpeachable.[1] It should not, however, be forgotten that glaciated mountains present certain smaller elements of form for which no satisfactory explanation has yet been offered; it is because these elements are truly subordinate to the prevailing larger features that they are not given consideration here. It must also not be overlooked that the actual processes of glacial erosion are not yet fully understood; as to this important problem it will only be noted that, while the plucking of large blocks must be important as long as the glacial bed is uneven, the scouring of ledges and the grinding of plucked blocks to fine waste must also be allowed great measure, because the coarse-textured moraines at the lower end of glaciated valleys are so small in comparison to the excavated spaces farther upstream.

Insufficience of arguments against glacial erosion.—A brief consideration may be given as to the insufficiency of certain arguments advanced by those who do not believe that glaciers have any significant power to erode valleys.

It has been noted that the ice at the side or the lower end of glaciers, where its movement against the adjoining rock is open to observation, will flow around a ledge instead of removing it. The same may be said of water; yet no one doubts that water, armed with rock waste, is an effective agent of erosion. It seems as if the essential element of abundant time were here neglected by the non-glacial-erosionists: for even if we accept the epigram that glaciers are to mountains what sandpaper is to furniture, it cannot be doubted that sandpaper would wear any piece of furniture down to nothing, if it were used long enough and if the supply of cutting sand were continually renewed. And it must be remembered that we cannot measure the duration of the several epochs of the glacial period in various mountain ranges until we know the rate and the amount of glacial work. At present both these quantities are more or less uncertain; it is therefore premature at present to conclude that glaciers cannot have done much work because they seem to work slowly.

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[1] A fine view of what appears to be a well-defined hanging lateral valley over a broad main valley with steepened sides in the Altai mountains, was reproduced from a volume on Siberia, by S. Turner, in this *Magazine*, vol. xxi., 1905, p. 654.

It has been urged that, once the loose material of preglacial weathering is scoured away, deeper glacial erosion is insignificant. This not only overlooks the possible long duration of a glacial epoch, whereby work of slow rate can reach a great amount; it also begs the whole question of the method of glacial erosion. There is much evidence from the detailed form of the cliffs and sills in glacial troughs that the plucking of joint blocks as well as the scouring of rock surfaces plays a large part in glacial erosion, and that this process goes on without any aid from weathering in the ordinary sense; that plucking may exceed scouring in the earlier stages of the modification of normal valleys to glacial troughs, if indeed it is not still an important process even after the troughs have been worn fairly round and smooth. In the absence of all opportunity for direct observation of this process beneath the trunk of a heavy glacier, it may be better determined by a comparison of the forms of once-glaciated and never-glaciated mountains than in any other way.

It is often pointed out that the lower end of a glacier advances over loose deposits without removing them; and to this may be added the unquestionable fact that broad and heavy sheets of till in the glaciated areas of Europe and North America lie upon unconsolidated gravels. To infer from these facts that glaciers cannot greatly erode their channels would be equivalent to inferring that a stream which descends from a mountain into a desert and lays down its detritus at its withering lower end, cannot erode the valley through which its upper course descends; or equivalent to inferring that the Ganges, which is spreading out a great delta among the distributaries near its mouth, cannot erode deep valleys in the mountains of its source. This argument cannot be accepted as valid until it is shown that the action of the small and vanishing lower end of a glacier may be fairly taken to represent the action of its heavy middle part. The contrasts between the bare rock-surfaces of the Scandinavian or the Laurentian highland and the heavy drift deposits on the plains of northern Germany or the prairies of the upper Mississippi valley suffice to prove that glacial action, like river action, varies from place to place; in both, erosion characterises the upper and middle parts, and deposition characterises the lower part. The glacial sculpture of mountains, as here set forth, is not in the least inconsistent with the glacial deposition of mountain waste on the piedmont lowlands.

It is sometimes said that rocky knobs, rising like those of Sion from a valley floor, and showing rough ledges on their down-valley side, contradict the idea of glacial erosion: for it is urged that, if glaciers erode, such knobs ought to be worn away. There are several unproved tacit postulates in this argument. It is silently assumed that the knobs in question retain approximately their preglacial form; but it may well be that they are unconsumed remnants of greatly eroded masses; and the choice between these alternatives is precisely the matter at issue. It is silently assumed that glaciers would not, if their work were interrupted at any accidental stage, leave knobs on their channel beds; yet no evidence is given to prove that the transformation of normal preglacial

valleys into well-rounded glacial troughs is not a progressive work, which would show many signs of being unfinished if time enough had not been allowed for the finishing. It is silently assumed that the production of rough ledges on the down-valley side of a knob are not within the possibilities of glacial erosion; but there is much evidence that a glacier may roughen one side of a rock mass by dragging or plucking away large blocks, while it smoothes the other side by scouring down pre-existent irregularities.

Insufficience of the explanations of special forms without glacial erosion.—Some of the explanations offered by non-glacial-erosionists for those peculiar forms of glaciated mountains here ascribed to glacial erosion may now be presented.

Large lakes, such as those which are piedmont to the Alps, are explained by the warping or local depression of preglacial valleys with subordinate aid from morainic barriers. The argument presented by Wallace against this view seems to me conclusive. If the lake basins are formed by the warping or damming of essentially unmodified preglacial valleys, the lake water should invade numerous side valleys, and thus form lateral bays; for the side valleys must have been, in preglacial time, worn down to accordant junction with their maturely wide open main valleys. It is well known that the Alpine lakes are singularly deficient in lateral bays. To test the value of this evidence, let any never-glaciated mountain range be examined to see what sort of a lake would be formed by warping or damming one of the larger valleys at the mountain base. The contrast between such a lake and the Alpine lakes is most striking. But it should be carefully borne in mind that, in the present explanation of piedmont lakes by glacial erosion, it is not only the lake basin, as Ramsay believed, but much of the valley depth and breadth within the mountains that has been worn out by ice action.

Cirques and the sharpened summit forms often associated with them have had so little close study, except by those who regard them as directly or indirectly of glacial origin, that they need not be further considered here.

Hanging lateral valleys, opening in the over-steepened walls of over-deepened main-valley troughs, have had several explanations. One of the most recent writers on this subject doubts whether hanging valleys are, after all, of so striking a character and of so peculiar a distribution as to constitute serious evidence for glacial erosion; he suggests that, when and where they do occur, some peculiar and sufficient, though now unknown explanation will probably be found for them, without having recourse to anything so extravagant as the deepening of the main-valley trough by ice action. This is simply a series of sceptical assumptions and vague suggestions that need not be answered until they are made more specific.

Another writer, recognising the hanging attitude of lateral valleys as characteristic of Alpine valley systems, suggests that the lateral valleys were occupied and protected from erosion by glaciers, while the main valley was deepened by normal river erosion. One objection to this is

its extreme improbability; for a series of independent glaciers could not agree to hold their ends at the mouths of the lateral valleys for a time long enough for the main valley to be deepened by hundreds and widened by thousands of feet below their level. Another objection, lately pointed out by Penck, is that hanging laterals occur not only where both trunk and lateral valleys were glaciated, but also in certain parts of the Alps where only the main valley was glaciated; in the latter case, the protection of the lateral valleys against erosion by the presence of lateral glaciers cannot be assumed.

A third explanation is to the effect that lateral valleys will be left "hanging," if the region in which they occur be tilted so as to steepen the slope of the main river but not of its branches. Apart from the sufficient objections that may be urged against this explanation, in view of the general principles of river action, it is pertinent and logical to ask that the possibility of such an origin for hanging lateral valleys should be tested in a region where tilting can be proved on independent grounds, and where glacial action has not taken place; indeed, one might fairly expect that the advocates of this explanation would be the first to test it in a non-glaciated region before putting faith in it, but they do not seem to have done so. It might be tested in the south-western slope of the central *massif* of France, or in the piedmont belt of the south-eastern United States, where the revival of valley erosion by regional tilting cannot be doubted; but no hanging lateral valleys occur there, although the main valleys are often of so moderate a width as to indicate that they have been exposed to erosion for a much shorter time than that which would be required by normal erosion in producing the wide main valleys above which the lateral valleys hang so conspicuously in glaciated mountains. Hence if a relatively short time has sufficed for the lateral streams to wear down their valley mouths as deep as the main valleys in these non-glaciated districts, a longer time should certainly have sufficed to bring about accordant junctions of lateral and main valleys in glaciated mountain ranges, on the supposition that normal erosion has alone been operative there. The fact that such accordant valley junctions do not prevail in glaciated ranges shows that the supposition just stated is erroneous.

A fourth explanation remains to be mentioned, and this, in its relations to the whole question of land sculpture, seems to me the most peculiar of all. This explanation asserts that, when local rains occur, they will contribute to the erosion of only certain of the lateral valleys, while the main valley will always receive some of the local rainfall and hence will always suffer some erosion at such times; therefore the main valley will be eroded faster than the laterals, which will consequently be left "hanging." This is tantamount to saying that hanging lateral valleys are normal features, to be expected in all mountain ranges as the result of the normal processes of erosion. Such a conclusion is contrary to experience and to the well-based principles of land sculpture. It gainsays Playfair's law, which is one of the best established generalisations in physiographic geology. It takes the Alps, a strongly glaciated range, as an example of normal mountain sculpture,

and thus begs the very question in discussion. It is here characterised as the most peculiar of all the explanations offered for hanging valleys, because it goes so directly counter to observation in other than glaciated regions. It is of course not to be forgotten for a moment that a large trunk river may, in its youth, cut down its valley faster than the smaller side streams can cut down theirs, and thus introduce a hanging arrangement of lateral valleys with respect to the trunk valley; but it must also not be forgotten that, as soon as the trunk river approaches grade, the further deepening of its valley is greatly retarded; and that then, while the trunk river devotes its energy (apart from that of transportation) chiefly to widening its valley floor, the side streams overtake it and develop accordant junctions of lateral and trunk valleys. In needs but little observation in non-glaciated areas to see that the chapter of early youth, in which a trunk river may be deeper than the mouths of the lateral valleys, is very short; that this peculiar relation only appears when the contrast between the volumes of trunk river and side stream is great; and that in all examples of non-glaciated mountains and plateaus, an accordant relation of lateral and main valley-floors obtains as soon as the main valleys acquire a significant breadth. The last point is of essential importance, because in all the examples of hanging lateral valleys of glaciated mountains yet described, the main valley is not a narrow cleft, in which hanging laterals would be normally appropriate, but a well-opened valley with respect to which hanging laterals are normally most inappropriate. In the Alps, the main valleys are half a mile, a mile, or over a mile in width. It is entirely out of the question to ascribe the over-deepening of these wide valleys to any normal process, independent of glacial action.

As to various other explanations of hanging valleys, they are essentially irrelevant. Sea-cliffs, strongly undercut by surf, may have valleys opening in their faces in hanging fashion; but this has no possible bearing on the hanging valleys of glaciated mountains. Faults may occasionally be found, recent enough in date to dislocate the valley floors that they traverse; but they should dislocate mountain flanks and ridges also. To suppose that the numerous hanging valleys of glaciated mountains are of this origin involves special conditions, at once so numerous and so improbable, that to state them is to discredit them.

A fallacy leading to a quandary.—In fine, it remains only to point out the two positions, on one or the other of which there is refuge for those conservatives who, on the ground of the apparent inefficiency of existing glaciers to erode their beds, hesitate to conclude that the piedmont lake basins, the over-deepened main valleys, the hanging side valleys, the valley-head cirques, and the sharpened peaks of glaciated mountains are the work, directly or indirectly, of ancient glaciers. The conservatives may, on the one hand, attempt to explain by normal erosive processes, as has just been suggested, the features which are here classed as peculiar; but so long as the peculiar features are found only in glaciated mountains, and so long as normal processes are not shown to be capable of producing them, the offered explanations by normal processes must be doubted. On the other hand, the conservatives who hesitate to accept

glacial erosion may suppose that, in preglacial times, some special agency or conspiracy of agencies, not now known, prophetically selected all those mountainous regions that were afterwards to be glaciated, worked upon them in essentially the manner that glaciers would work if they could, and then withdrew into obscure inactivity. But this is incredible, because the unknown agency or agencies could not possibly have been so circumspect as to produce only small cirques and short trough-valleys in the high mountains of low latitudes and in the lower mountains of middle latitudes; as to produce, in the high mountains of middle latitudes and in the lower mountains of high latitudes, large cirques and long main-valley troughs, over which the side valleys open in the most significant hanging fashion; and as to produce in these valleys and their cirque heads a great number of rock basins in which lakes now stand. Either one of these refuges for the conservative is so uncomfortable a quandary, that the road leading to it must be regarded as lying on fallacious ground.

It is thus both along direct and indirect lines of evidence that many observers have been led in recent years away from the supposition that glaciers cannot erode, and toward the supposition that glaciers can erode, even though the methods of glacial erosion are not yet fully understood. The sculpture of mountains by glaciers is indeed now proved by so many facts, widely and yet systematically distributed, that it savours of extreme conservatism any longer to deny the efficacy of glacial erosion.

THE VOYAGE OF THE "DISCOVERY."[1]

THOSE of our readers who heard Lieutenant Shackleton's lecture in February 1904, and Captain Scott's address at the anniversary meeting of the Royal Scottish Geographical Society the same year, will be prepared to give a hearty welcome to these interesting and beautifully illustrated volumes. At both these meetings the lecturers were necessarily hampered by the limits of time, but we heard from them sufficient to make us expect, that when the story of "The Voyage of the *Discovery*" came to be told *in extenso*, it would be one of surpassing interest; and the readers of these volumes will certainly not be disappointed, however high the expectations they may have framed. In his preface Captain Scott modestly disclaims for the work any literary merits; but even in this respect he has nothing to fear when his work is compared with the now classic narratives of such distinguished rivals as Nansen and Peary in his own line, or Stanley and Sven Hedin in another.

By way of introduction to his subject, Captain Scott passes in rapid but appreciative and well-proportioned review the various attempts which had been made to penetrate the Antarctic circle previous to the

[1] *The Voyage of the "Discovery."* By Captain Robert F. Scott, R.N. Two volumes. London: Smith, Elder and Co., 1905. Price 42*s. net*.

dispatch of the *Discovery*, and which have immortalised such names as Vasco de Gama, Drake, Cook, Bellingshausen, Weddell, Wilkes, and Ross, after whose time there was a distinct falling off and lull in the interest taken by the public in Antarctic problems. This want of interest, however, came to an end in 1875, when the *Challenger* returned home from its famous cruise, and Sir John Murray, our late President, with characteristic energy and skill again and again brought the subject prominently before the public. In 1893 the question was taken up by the Royal Geographical Society of London, under the presidency of the veteran explorer Sir Clements Markham, but although supported by a strong body of scientists and geographers, Sir Clements failed to induce the Government to send out an expedition. Undaunted by this failure, Sir Clements and the Royal Geographical Society in London appealed to the Royal Society to join them in an appeal to the public, and this joint appeal was crowned with success. A considerable fund was collected, in which the munificent donation of £25,000 by Mr. Longstaff may be mentioned, after which the Government was again approached, this time with success, as Government consented to provide a sum of £45,000, if private generosity provided as much. In this way the financial difficulty was solved, and in March 1900 the keel of the *Discovery* was laid in the yard of the Dundee Shipbuilding Company. The onerous duty of drawing up instructions for the conduct of the expedition was intrusted to a band of experts, scientists and explorers, which included the best experience and brains of Great Britain. Commander Scott, R.N., was appointed to the command of the expedition, and spent a busy year in preparing himself for the task. He cordially acknowledges the useful and ready assistance he got from such distinguished explorers as Nansen and Drygalski. The instructions which were to guide Captain Scott in carrying out the objects of the expedition were ultimately drawn up by a small committee.

Captain Scott was exceptionally fortunate in securing as his comrades a band of officers, navigators, scientists, engineers, and doctors, as well as warrant officers and men, of whom he can now speak in heartfelt and unstinted praise. The ward-room officers were young and had had much diversity of experience, the latter advantage being quite as great as the former.

On the 6th August 1901 the *Discovery* left the shores of England on its southward voyage, touched at Funchal in Madeira on the 14th, crossed the Line on the 31st, reached Table Bay at the Cape of Good Hope on the 3rd October, fell in with sea-ice for the first time on the 16th November, and arrived at Lyttelton in New Zealand on the 29th. There the ship was subjected to a thorough and final overhauling, and Mr. Bernacchi, the physicist, joined the expedition. He had already spent a winter at Cape Adare, when he served in Sir George Newnes's expedition in 1896. The *Discovery* left New Zealand on Christmas Eve, and sighted icebergs on 2nd January 1902. Next day the party crossed the Antarctic circle, and on the 8th they sighted the Antarctic Continent; next day they entered Robertson Bay and landed on the peninsula of Cape Adare. There they found the hut which had been used by the

members of Sir George Newnes's expedition, and some of the staff of the *Discovery* paid a sorrowful visit to the grave of Hanson, the naturalist of the 1896 expedition. Next day they resumed their course to the south, and for the first time found serious difficulty in getting through the pack-ice. After this they encountered heavy gales and squalls, the wind force sometimes measuring by the anemometer as much as ninety miles an hour. On getting beyond Cape Washington they were completely clear for a time, but only for a time, of the pack-ice. Pushing onward and onward to the south, the *Discovery* put into Granite Harbour, which looked a tempting place for winter quarters. On the 22nd it steamed into M'Murdo Sound, within a few miles of the place which was destined to be the winter quarters for two years. Captain Scott's first impression of the scene was this: "To the right is a lofty range of mountains with one very high peak far inland, and to the south a peculiar conical mountain, seemingly ending the coastline in this direction; on the left is Mount Erebus, its foothills, and a glimpse of Mount Terror. The Parry Mountains cannot be seen ahead of us." The conical mountain was named Mount Discovery, and the high mountains to the west were named the Royal Society Mountains. By this time the expedition had already justified its existence; for "a coastline which had hitherto been seen only at a great distance, and reported so indefinitely as to leave doubts in many minds with regard to its continuity, had been resolved into a concrete chain of mountains: the positions and forms of individual heights, with the curious ice formations and the general line of the coast, had been observed. The lofty peaks of Northern Victoria Land had been seen to be succeeded by a comparatively low mountainous country of peculiarly suggestive topographical outline, behind which a vast interior ice-cap appeared to rise to greater heights. Towards the 78th parallel the flanking ranges of the continent again rose to great altitudes, and yet farther south we could see no tendency in them to turn towards the east as had been supposed."

But before settling down in winter quarters there was much to be done, and the *Discovery* turned to the east, to coast along and explore as far as possible the great barrier of ice which fringes the Antarctic continent. To Ross the barrier had presented an appearance of uniform height; but Ross in his sailing-ship did not dare to approach as close as Captain Scott in the *Discovery*. The great ice-barrier was found to vary in height from a few feet to 280 feet above sea-level. Another error on the part of Ross was dissipated in this voyage, *i.e.* the mountains, which he imagined he had discovered, and had named the Parry Mountains, were found to be non-existent. On the 1st February, however, land, *i.e.* King Edward Land, was sighted, and two groups of hills were seen, the height of which was calculated to be between 2000 and 3000 feet. This was the limit of the voyage to the east, as with great reluctance and because of the limited supply of coals, Captain Scott decided that he must return to seek winter quarters in M'Murdo Sound. On the way back he had a view of the ice-barrier from a balloon at the height of 800 feet.

On the 8th February the *Discovery* entered M'Murdo Sound, and

soon afterwards a suitable position for winter quarters was selected in a small bay on the south side of a promontory.

Winter quarters once selected, the work of preparing for the long winter night was at once taken in hand. The main hut and the smaller ones for the magnetic instruments were soon erected; kennels for the dogs were made ready on the hillsides; provisions were landed, a large supply of seal meat for winter consumption was secured, and arrangements were made for a fresh-water supply. The dogs had to be trained for sledge work, and tentative sledge expeditions were undertaken for the benefit both of the dogs and of the members of the expedition. Captain Scott had expected that the *Discovery* would become ice-bound within a comparatively short time after its arrival in M'Murdo Sound; but as a matter of fact it was not till nearly the end of March that the ship was finally closed in by the ice. But ere this happened, there occurred the first of the only two serious mishaps to members of the expedition, viz. the death of Vince, who on the 11th March slipped along an ice-slope and over a precipice into the sea while returning to the ship from a sledging expedition to Cape Crozier.

Meantime the days were getting shorter and shorter, and the ordinary and regular work of the expedition in all its scientific departments was getting more and more trying. At length, on April 20th, we find this entry in the diary: "The sun is very near its departure; to-day it appeared a highly refracted elliptical ball of red, giving little light and no appreciable heat. For a few minutes it bathed the top of Observation Hill in soft pink light, then vanished beneath a blood-red horizon." It had disappeared for four months, a period which might have seemed long and dreary, but which in reality was not so, owing to the excellent arrangements both for work and play which prevailed on the *Discovery*. That there was so little sickness on board must be set down to the credit of the commander and the two doctors, Koettlitz and Wilson. Certainly what must have tried both officers and men more than anything else was the persistent bad weather. A calm day was quite exceptional, and the diary records with a mournful iteration, squalls, gales, and hurricanes, which must have been as trying to the patience and good temper as to the physique of all exposed to them.

On the 23rd August the sun reappeared, and during the month of September a number of short sledging expeditions were made with a view to testing the dogs and the members of the various parties, and to ascertain and correct any remaining defects which might be discovered in the arrangements. All seemed going on well, when the spirits of the Commander, and of every one else, might have been considerably damped by an outbreak of scurvy; but the skilful and energetic measures taken by the doctors prevented its spreading very far, and by the 20th October the disease was at an end. Unfortunately, notwithstanding every desire and effort to account for the origin of the outbreak, it was impossible to ascertain with certainty how it made its appearance. By the end of October every arrangement had been made for the summer journey to the south, and on the 30th the supporting party made a start. It was followed by Captain Scott with the main body on the 2nd November,

and was caught up on the same day, as bad weather had prevented much progress. The two parties proceeded together till the 13th November, by which time they had reached nearly up to the 79th parallel, and had therefore broken the record of Southern exploration. Half the supporting party then retraced their way back to the ship.

On the 15th November the remainder of the supporting party returned back towards the ship, and Captain Scott, Lieutenant Shackleton, and Dr. Wilson proceeded alone with the sledges and dogs to the south. In a very few days, however, it was obvious that the dogs were breaking down owing to the mistake of their being fed with unsuitable stockfish. They proved to be unfit to pull the heavily laden sledges, and an attempt was made to mend matters by dividing the load into two parts and bringing on one at a time; thus every mile had to be traversed three times. Under these circumstances the rate of progress was distressingly slow, and necessarily got slower and slower. On the 10th December Captain Scott records that "yesterday we only covered two miles." On the 14th, after thirty-one days of incessant toil, the relief system was brought to an end by the transfer of a large part of the stores to a depôt. Another start was made on lightened sledges, but in a few days the dogs got weaker and weaker, and fewer and fewer, and, what was much worse, symptoms of scurvy appeared. On the other hand the explorers felt that "day by day, as we journeyed on, we knew we were penetrating farther and farther into the unknown; each footstep was a gain, and made the result of our labour more solid. It would be difficult to describe with what eagerness we studied the slowly revolving sledge-meter, or looked for the calculated results of our observations, while ever before our eyes was the line which we were now drawing on the white space of the Antarctic chart. Day by day, too, though somewhat slowly, there passed on that magnificent panorama of the western land. Rarely a march passed without the disclosure of some new feature; something on which the eye of man had never yet rested; we should have been poor souls indeed had we not been elated at the privilege of being the first to gaze on these splendid scenes." To the west, on their right hand, was the peak of Christmas Mountain; due south, beyond the 83rd parallel, stood out Mount Longstaff, a grand peak over 10,000 feet high; and, slightly west of it, the Markham Mountains, the highest of which reaches an altitude of 15,100 feet. On the 30th December Captain Scott enters in his diary: "This camp we have now decided must be our last, for we have less than a fortnight's provisions to take us back to depôt B, and with the dogs in their present state it would be impossible to make forced marches; we have, therefore, reached our southerly limit. Observations give it as between 82·16° S. and 82·17° S.; if this compares poorly with our hopes and expectations on leaving the ship, it is a more favourable result than we anticipated when those hopes were first blighted by the failure of the dog team." On the return journey it was found that the dogs were worse than useless, and so the three comrades themselves undertook the task of dragging the sledges, and in this way much better progress was made than before. Still, what with bad weather and general weakness,

they did not reach the food depôt till the 13th January, and next day a medical examination disclosed the unfortunate fact that all three members of the party had symptoms of scurvy. Of the three Lieut. Shackleton was much the greatest sufferer. It was a question of whether or not he would be able to reach the ship alive, so all thought of exploring the north coast was given up, the remaining dogs were killed, the sledges were lightened as much as possible, and to get back to the *Discovery* as quickly as possible was the first consideration. Even if the party had been able to march rapidly the weather was very much against rapid progress, being constantly overcast and misty, so that it was exceedingly difficult to take bearings; in this way it was not till the 28th January that they reached the depôt A and for the first time for many days had a sufficient meal of good food. On the 3rd February the weary but intrepid explorers reached the ship. They had been absent for ninety-three days, during which they had covered 960 miles under conditions of hardship which are probably unrivalled in the annals of exploration.

During Captain Scott's absence from the ship all had gone well, and some exploring had been accomplished. The most important expedition was that of Lieutenant Armitage's party, who have the honour of being the first to enter and explore a part of the interior of Victoria Land. They were unlucky in their selection of a route up the formidable Ferrar glacier, and by the 3rd January, when they had reached the ice-cap and a height of nearly 9000 feet, it became necessary to return. South-west of the winter quarters the other officers had done good work by making short trips, exploring as much of the tracts as their limited means of travelling permitted. In this way it was demonstrated that Black Island was really an island, and that the decayed and water-worn ice on which they had landed in February 1902 was the end of the lateral moraine of the Great Ice Barrier. In the meantime there arrived the relief ship *Morning*, which had left London for the south on the 9th July 1902, and in the search for traces of the *Discovery* had touched at Cape Adare, Possession Islands, Franklin Island, and on the 18th January had found at Cape Crozier a tin cylinder wherein Captain Scott had placed directions indicating that his winter quarters were in M'Murdo Sound. On the 24th communications between the *Morning* and the *Discovery* were established; the relief, the joy and delight of such a moment can hardly be imagined; they cannot be described.

Many days of the month of February had not elapsed ere it dawned on Captain Scott that it was quite possible, and indeed probable, that the *Discovery* would not be freed from its ice-bound position and that they would have to spend a second winter where they were. The *Morning* could not stay with them, so the work of removing stores from the one ship to the other was pushed on as fast as possible. By the end of the month the probability had become a certainty, and the necessary arrangements consequent thereon admitted of no further delay. On the morning of the 3rd February the relief ship turned its bows to the north, and the members of the *Discovery* Expedition were again left alone to face the unknown future. The first business was to secure a sufficient supply of fresh meat, and for this purpose 116 seals

and 275 skua gulls were killed, which, with 20 sheep, were estimated sufficient for a period of 275 days. On the 24th April the sun disappeared, and the officers and crew resumed the routine of the previous winter. Acetylene gas was substituted for paraffin oil and candles with most satisfactory results. In May they got some record temperatures such as $-66°$ and $-67{\cdot}7°$; in the middle of June the terrible blizzards began; in July there was an unusually remarkable eruption of Mount Erebus; on August 31st the sun reappeared.

For the ensuing summer season Captain Scott had decided on having three expeditions, one under himself "to explore the Ferrar glacier from a geological point of view and to find out the nature of the interior ice-cap"; a second to explore one of the extraordinary straits in the south "which had appeared to run through the mountain ranges without rising in level," and a third to ascertain "if the barrier surface continued on a level to the eastward." It was understood that all three parties were to be back at the ship by the middle of December to help, if need be, in the release of the ship from the ice. Captain Scott, remembering the misadventures of Lieutenant Armitage's party in the previous season, endeavoured as a preliminary measure to find a more easy route of ascent of the formidable glacier, and he found that by holding more to the north he was able to take his party to the top without much trouble.

On his return to the ship after this preliminary reconnaissance of the glacier, Captain Scott found that a party which had been laying out a depôt on White Island had experienced cold that was unusual even for the Antarctic regions. At $-67{\cdot}7°$ the spirit column of the thermometer had broken, and Barne, the leader of the party, believed the cold was below $-70°$. A party which had gone to Cape Crozier had had the good luck to find a number of Emperor Penguin eggs and chicks.

On the 6th October Barne and Mulock started with a party to the south to explore and report on "the big strait since called the Barne inlet." On the 12th Captain Scott started to the west on the more important work of penetrating and exploring the interior of Victoria Land. But only six days after the start it was found necessary to return to the ship to repair the sledges; and the general health, physique, and eagerness of the party may be gauged by the fact that, on the 21st October, they covered thirty-six miles of ground, and some of them, *i.e.* the supporting party, covered thirty-seven. On the 26th October a fresh start was made, but it was not till the 12th November that the party reached the summit of the glacier, 8900 feet above the level of the sea, having been storm-stayed, or rather blizzard-stayed, at one place for a whole week. After ten days' severe toil dragging the sledges, one of the party showed signs of breaking down, so Captain Scott decided to send back three of his comrades, while he and two others, viz. Lashly and Evans, were to continue for some days longer.

During the first days of the return march the weather was atrocious and prevented much progress being made, sometimes hardly more than a mile an hour, and provisions began to run short. On the 15th December, in the early morning all three members of the party were nearly killed by slipping some 300 feet down an ice-cascade, and later

on in the same day Captain Scott and Evans fell into a crevasse and again had a very narrow escape for their lives. They reached the *Discovery* on Christmas Eve, having in eighty-one days covered 1098 miles and climbed heights aggregating 19,800 feet. In their absence the geologist, Ferrar, had been exploring the glacier valley and bringing away specimens of the rocks. The party headed by Barne had encountered such bad weather that they merely reached the mouth of the inlet they had intended to explore, but Mulock managed to survey the coastline and to fix the position and height of more than two hundred mountain peaks. It was also definitely ascertained that the Great Barrier Ice sheet was not stationary. Valuable magnetic observations taken by Bernacchi were the principal result of the south-eastern expedition.

At the beginning of the year 1904 there were twenty miles of ice between the *Discovery* and the open sea; all attempts to assist nature in freeing the ship by sawing through and blasting the ice proved a total failure; and appearances generally were such that Captain Scott began to contemplate the possibility of spending a third winter where he was. But on the 5th January the arrival of two relief ships, the *Morning* and the *Terra Nova*, brought a complete and welcome change in the aspect of affairs. The second ship had been sent by the Admiralty in view of the contingency that it might be found necessary to abandon the *Discovery*, if she could not be freed from the ice in time to join the relief ships on their journey home. It needs no great effort of imagination to join Captain Scott and his comrades in their feelings of consternation and sorrow at the prospect of having to abandon the *Discovery* in its ice-bound prison. That catastrophe, however, was not to be. On the 14th February the *Discovery* was released from its prison, and on the 16th February 1904 she again rode the high seas, but her troubles were by no means over. There came another wearisome spell of gales and squally weather, and it was with the greatest difficulty that the ship could be got out into the open sea. At first the course was to the west, but on being involved in the pack-ice they turned to the north-east, but they were repeatedly forced to change their direction. Early in March they approached a group of islands, an accurate observation of which disclosed the fact that they were what Balleny in 1839 had discovered and called Sturge Island, and Ross in 1842 had called the Russell Islands. Each explorer had approached the islands from a different direction, and Ross was unaware that Balleny had anticipated his discovery. On the 15th March the *Discovery* entered Ross Harbour, where in a few days it was joined by the *Morning* and the *Terra Nova*. On the 1st April they were safe at Lyttelton in New Zealand, where they found as hearty a welcome as, more than two years before, they had found a set-off. They enjoyed a welcome and much-needed rest of a couple of months ere they set sail for England, where on the 10th September they reached Spithead to be received with the well-deserved acclamations of their countrymen.

The story of *The Voyage of the "Discovery"* has been told to us by Captain Scott in the bright, cheerful, simple and vigorous language which is distinctive of his profession; as we read it we are impressed

with its simplicity and verisimilitude, but we cannot fail to observe the undercurrent of strenuous devotion, loyalty, and whole-hearted determination under every circumstances to do his duty, which animated the leader and every member of the party from the beginning to the end of the expedition. We notice also the generous anxiety of the writer to attribute to each of his subordinates the full credit which he deserves, and while in no way concealing the special cares of leadership, he gladly points out how they were minimised and spared to him by the courage, devotion, and skill of his comrades, of each and all of whom it can be truthfully said, that what men could do in the circumstances in which they were placed, they thoroughly did. They have substantially added to the glory of English seamen and of English scientists; and they have enrolled themselves in the immortal list of Antarctic explorers.

It is impossible to conclude a notice of this work without referring to the maps and the illustrations. The former are the work of Lieutenant G. F. A. Mulock, R.N., and with their assistance the reader can easily follow not only the routes of Captain Scott and the *Discovery*, but also the expeditions of the various sledging-parties in all directions from their winter quarters. The illustrations, including the coloured plates, number about three hundred, taken mostly by Dr. Wilson, and maintain a high standard of excellence. With the aid of these maps and illustrations and Captain Scott's most interesting narrative, the reader can frame a good idea of what occurred from the beginning to the end of this famous expedition.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

On the 26th December, in the Free Assembly Hall, Miss A. L. A. Murcutt delivered a lecture on "The Ainus of Japan." Sir Colin G. Macrae occupied the Chair.

Miss Murcutt repeated her address before the Glasgow Centre on the 27th, Dr. Paul Rottenburg, Chairman of the Branch, presiding; also on the 28th and 29th in Dundee and Aberdeen, Mr. I. Julius Weinberg and Mrs. Archibald Forbes respectively occupying the Chair.

Lectures in January.

On January 4th, Major C. H. D. Ryder, D.S.O., R.E., addressed the Society in Edinburgh on the "Expedition to Lhasa and subsequent Explorations," Colonel T. Cadell, V.C., presiding. On the motion of Lord Playfair a hearty vote of thanks was awarded the lecturer. Before the address, the Society's Silver Medal was presented to Major Ryder for his explorations in Western Tibet.

Major Ryder repeated his address on the 5th, 9th, and 10th January before the Glasgow, Dundee, and Aberdeen Centres. Dr. Paul Rottenburg occupied the Chair in Glasgow, and Ex-Lord Provost Barrie, and Mr. George Davidson of Welwood, in Dundee and Aberdeen respectively.

On the 25th January Mr. R. N. Hall, F.R.G.S., repeated his address in Edinburgh on "The Buried City of the Great Zimbabwe," Professor James Geikie, D.C.L., LL.D., President of the Society, presiding.

At Dundee on January 25th, and Aberdeen on January 26th, Dr. Charles Sarolea, D.Ph., D.Lit., delivered an address on "Russia and the Caucasus," Mr. Victor Fraenkl, J.P., and Professor James Black Baillie, D.Phil., respectively occupying the Chair.

Sir Charles N. E. Eliot, K.C.M.G., C.B., delivered an address before the Glasgow Centre on January 30th on a journey 'From Mombasa to Khartum: through Uganda and down the Nile."

At a Meeting of Council held on the 9th January the undermentioned ladies and gentlemen were elected members of the Society :—

Alex. Simpson.
Alex. Hood.
Wm. Bruce Lindsay.
John Herdman.
C. B. BoogWatson, F.R.S.E.
Lionel W. Hinxman, B.A., F.R.S.E.
John Jamieson.
Miss Ritchie.
Miss G. Gracie.
J. G. Kelly.
George Cadell.
Miss Blackwood.
Wm. B. Melrose.
Rev. James Davidson, M.A.
Rev. John D. Kilburn.
Mrs. G. Pesel.
A. M. Anderson, M.A., LL.B.
Mrs. Baird.
Andrew Sharp.
J. F. Fairweather, W.S.
John Burns, W.S.
Lieutenant E. H. Shackleton.
Robert Wilson.
Adam Tait.
A. Ernest Harley.
D. S. Calderwood, M.A.
Arthur Lassell.
Miss Steven.
David Hamilton.
David Low.
C. F. Henderson.
Prof. Chas. Niven, M.A., D.Sc., F.R.S.
W. Todd Moffatt.
A. Marshall Mackenzie, A.R.S.A.
William Alison.
Miss Jessie Ackermann.
James Reid.
George Mackie.
J. Hepworth.
Edward L. Walker.
John Raeburn.
R. N. Ramsay.
Alex. D. Donald, B.L.
James Mouceur.
Mrs. G. Manson.
Thomas Drybrough.
A. Brown Campbell, LL.B., W.S.
A. G. Brown, W.S.
J. Murdoch.
Miss Macqueen.
David Dickson.
W. S. Porteous, F.S.A. Scot.
Donald Crawford, K.C.
Spencer C. Thomson.
Mrs. H. Dorr.
G. R. M'Gibbon.
Henry F. Kerr.
S. Milne Buchan.
C. F. Robertson.
Peter Morison, S.S.C.
T. Skene Esson, W.S.
Lewis I. Cadell, W.S.
Lieut. F. H. Franks.
Allan Hall.
David Brooks.
John Adam.
Rev. W. Lyall Wilson, M.A.
Andrew Spalding.
Miss Maria Low.
Miss M. Forbes Pirie.
David Edwards.
John Thomson.
Robt. Hinde Douglas, F.R.G.S.
James Davidson.
Ivan Gutmann.
W. Caldwell Crawford.
Robt. M'Arthur.
Matthew White.
Hugh M'Crostie.
W. F. Harvey.
Wm. Hunter.
Thomas W. Cockburn.
Frank J. Usher.
J. W. Moir.
E. T. Hanson, B.A.
J. Lamb, C.A., F.F.A.
Miss K. L. Burleigh.
J. Penman Browne.
C. H. M'A'Fee.
Alex. G. Robin.
Alex. Stables.
Miss. J. G. Campbell.
Robt. C. Paterson.
Miss I. Stirling.
George B. Stirling, C.A.
Andrew Rowan.
William Brownlie.
Alex. Macfarlane.
W. E. Auld Graham.
William Martin.
J. R. Leslie.
Thomas Baird.
C. Templeman, J.P., M.D., D.Sc.
Rev. J. M'P. Cunningham, M.A.
A. F. Woodburn, I.C.S. (Ret.)
Rev. J. Hector, M.A., D.D.
Wm. M. Ledingham.
Colonel J. Davidson.
John Cameron, M.L.A.

At the same meeting the Diploma of Fellowship was conferred upon the following members :—

Miss Jessie A. Ackermann.
J. H. Ballantyne, M.R.P.S.G., M.I.E.S.
William Maclay, F.G.S., A.M.I.E.E., Past V.-P. of the Geological Society of Glasgow.
Peter Hume Maclaren, M.D., F.R.C.S.E.
Robert M. Mann.
W. Bertram Miller.
C. Hope Murray, Junr.
James Reid.
E. H. Shackleton, F.R.G.S., F.R.A.S., Silver Medallist, Royal Geographical Society.
Harry W. Smith, W.S.
Chas. John Wilson.

GEOGRAPHICAL NOTES.

EUROPE.

Malaria in Spain.—The *Boletín de la Real Sociedad Geográfica* (iii. 7) contains a note on the distribution of malaria in Spain after Dr. Gustavo Pittaluga, which is of some interest. According to the data collected by this author, simple tertian (*plasmodium vivax*), accompanied at times (Sept.-Oct.), and followed (Nov.-Dec.) in rare cases by quartan (*plasmodium malariæ*), predominates from June in the malarial regions of the following provinces:—Baleares, especially on the N. and SW. coast of Mallorca; Barcelona, the plain of Llobregat, etc.; Castellón de la Plana, valley of the Mijares, and almost all the coast towards the Province of Valencia; Cuenca, valley of the Guadiela del Norte, the Huete, and the Júcar; Gerona, the coast of the bay of Rosas, Ampurdán, Figueras; Guadalajara and Madrid, valleys of the Tagus, Tajuña, Henares, Jarama, Guadarrama; Lérida, plain of Urgel towards Balaguer and Cervera on the NE.; Tarragona, chiefly in the delta of the Ebro, from Tortosa to Amposta and San Carlos de la Rapita; Valencia, valleys of the Turia and Júcar to Gandía on the S.; Zaragoza, Los Monegros, on the left of the Ebro, and other places in the confluent valleys, between Cortés higher up, and La Puebla and Caspe lower down.

The acute pernicious form, prevalent in late summer and autumn, predominates in Cáceres (line of Plasencia to Valencia de Alcántara), Badajoz (almost all the Portuguese frontier and the valleys to the left of the Guadiana), and roughly speaking, the greater part of Andalusia and Murcia, more especially in the valley of the Segura, towards Lorca.

In almost all the other provinces, there are regions in which malaria may be said to be endemic. Indeed, there are not more than four or five which may be considered as free, Alava, Guipúzcoa, Viscaya, Santander and Pontavedra, and even there, cases occur every now and again.

Alpine Botanical Congress.—A preliminary programme has been issued of the second Alpine Botanical Congress which is to be held in August this year at Pont de Nant sur Bex, the Alpine Garden of the University of Lausanne. The programme, which bears the signature of Professors Ch. Flahault of Montpellier and E. Wilczek of Lausanne, invites discussion on a wide range of problems, botanical and geographical. The first part deals with the general objects to be obtained, the needs of comparing observations made at alpine and polar stations, and the organisation and arrangement of alpine gardens in general. The second part of the programme is concerned with the various ecological aspects of alpine floras, while the question of botanical cartography receives attention. Lastly, several economic considerations find a place in the programme, among which are forests and re-afforestation; the influence of trees on the soil and on the volume of rivers; the selection of suitable forest species for re-afforestation; mountain pasturage and the possibilities of improving it; and vegetable, fruit, and flower cultivation in mountain regions.

The circular emphasises the neglected state of agriculture in many

mountain districts, and the improvement that would ensue in all probability should these gardens, in addition to their purely scientific work, become centres of research in economic problems.

Asia.

The Population of Japan.—An article in *Le Tour du Monde* (Dec. 16) discusses the somewhat interesting question whether or not it is true that Japan requires new territory for her surplus population. The affirmative has been recently strongly maintained both in Japanese and European journals, but Professor Réne Gonnard of Lyons is of opinion that the arguments by which this opinion has been supported are fallacious. In 1901 the population of Japan was 47,608,875, that is, it exceeds the population of Italy, of France, of Great Britain, and of Austria-Hungary, and is inferior to that of Germany, but when the density of the population is calculated, it is found that while the figure for Japan (113 per square kilometre) is relatively great compared with Russia (19), Austria-Hungary (72), France (73), or even with Germany (104), it is less than that of Italy (115), Great Britain (132), the Netherlands (162), and Belgium (234). The obvious retort that these figures may represent in each case the population which the land is able to support, is met by M. Gonnard by the statement that the resources of Japan are not yet fully developed. He further denies that the increase of population in Japan is so rapid as to necessitate extensive emigration. The birthrate is only 29 per 1000, which is less than that of the majority of European nations. Thus it is 30 in Great Britain, 36 in Germany and Italy, 37 in Austria, and 48·4 in Russia. Further, the birth-rate shows signs of falling since the Europeanisation of the country, and will probably fall still further. The author's conclusion is therefore that there is room enough and to spare for the Japanese within their own archipelago.

American Expedition to Turkestan.—News has come to hand of the progress of Mr. R. L. Barrett and Mr. Huntington, who left London last February (cf. this *Magazine*, xxi. p. 155) on a journey of exploration in Central Asia.

Writing early last October from Keriya, on the edge of the desert, in Eastern Turkestan, Mr. Huntington announced that the previous three months had been spent in examining the country between Khotan and Keriya. Excursions were made north and south of the road between Khotan and Keriya, up and down the valleys of the streams which descend from the mountains to the fringes of the desert. There are four such streams at the present day, and if the courses of the streams were prolonged into the desert they would be found to converge, suggesting that at some previous period a single river may have been formed by the confluence of the four. This theory is strengthened by the discovery, along the lines of prolongation, of deserted villages, which in some cases were evidently at one time the centres of considerable agricultural districts. One village was abandoned so late as 1840, directly on account, it is reported, of the growing scarcity of water. Droughts of increasing severity had been experienced. In seven succes-

sive years the stream ran dry in winter. Wells were dug, but the area of possible cultivation grew more and more restricted, until finally the whole village was moved further upstream. Below the deserted site are found the remains of other villages, and all the evidence seems to point to the fact that the sites were abandoned on account of the gradual desiccation of the country. The villages appear to have been carefully cleared of all portable property, and patches of dead jungle indicate that vegetation once flourished where the aridity of the soil now forbids its growth.

Mr. Huntington does not go so far as to admit that these and similar facts establish the theory that Central Asia has been undergoing a process of desiccation in historical times; but the question is one in which he is keenly interested, and which he intends to bear prominently in mind throughout the expedition. What has also particularly excited his interest is the striking resemblance, so far as his observations have gone, of the Tarim Basin to an inland sea. Indeed, but for the accident of the absence of water, it would be a genuine Mediterranean. Here also there are traces of volcanic activity in times no further back than the early part of the Glacial period. The Tarim Basin comprises the Takla Makan Desert, and Mr. Huntington considers that perhaps the most remarkable physiographical characteristic of the region is its arrangement in concentric rings. In the heart of the desert are waves of reddish sand, which turn to a whitish or greyish colour as one nears the circumference. On the borders of this area mounds, clothed with tamarisk bushes, rise to a height of twenty or thirty feet, and look like giant weed-covered boulders, which are gradually being overwhelmed by the rising tide of sand. Behind come the jungle of tamarisks and poplars and the broken belt of oases, recalling a stretch of green tide flats with reedy lagoons in the background. Still nearer the mountains lies a waste gravel belt, from five to twenty miles in width, which may be likened to some broad shingly beach.

In October Mr. Barrett and Mr. Huntington had finished their work together, and were taking charge of separate expeditions. Mr. Barrett intended to remain some time longer on the southern fringe of the Tarim Basin, while Mr. Huntington was proceeding to the Lop Nor region for the winter, and hoped in the spring to visit the Turfan depression further north.

On the way from India to Khotan a side excursion was made from Leh, in Kashmir, to the Pang-kong Lake on the borders of Tibet, situated at an elevation of 14,000 feet. As a result of his observations there, Mr. Huntington is of opinion that the lake basin is glacial in origin.

Dr. Sven Hedin's New Expedition.—Dr. Sven Hedin arrived at Teheran on December 13 from Constantinople. He proceeded to Batum, whence, after a twelve days' forced stay on account of the railway service in the Caucasus being disorganised, he went to Trebizond, and thence made the journey to Erzerum and Tabriz. He left Teheran on January 1 with a caravan of fourteen camels and seven men, for the exploration of the desert region of Eastern Persia, in order to compare its features with those of Central Asia. He stated that he hoped to reach Quetta, by way of Sistan and Nushki, in three months, and to be

at Simla in April. There he would ascertain the most suitable route for crossing the Himalayas. He will then make his way to Southern Tibet, to investigate the source of the Indus and Brahmaputra (cf. this *Magazine*, vol. xxi. p. 660).

Africa.

The Hydrography of Lake Chad.—In *La Géographie* for November 15 last there appears an article on Lake Chad by M. Audoin, which is interesting because it repeats the description of the gradual drying up of the district, already told by so many observers. At a later stage a map of the lake based upon the recent French observations is to appear in *La Géographie*, and meantime M. Audoin gives a section to illustrate the general characteristics of the lake. Such a section, taken from the Kanem to the Bornu shore, shows that the lake basin is divided into three zones. The western zone is made up of islands of siliceous sand, varying from 12 to 15 metres in height, and diminishing as one proceeds from the east towards the west. On these islands are placed villages and plantations. The vegetation consists largely of spiny mimosas, a palm (*Hyphæna*), Calotropis, Balanites, and the very light "ambatch" (*Herminiera*), which is utilised by the natives in making floats. The second zone is composed of flat islands, about two to three metres above the water-line, whose vegetation consists of ambatch and Calotropis, and which serve as pastures for the native cattle. The third zone consists of the open water so-called, but even here the shallows carry growths of young ambatch and other plants, rendering navigation very laborious. The process of desiccation is continuous, and seems to be taking place at such a rate that the loss to the lake is about 0.15 m. per annum, that is, an interval of about thirteen years is sufficient to cause a new island of two metres in height to rise from the water. The consequence of this rapid change must be that the lake will more and more become impassable for boats. M. Audoin says that soon the open water will be confined to two separate basins, separated by a line across the former island of Seyorum, the upper of which will receive the waters of the Komadugu, and the lower of the Shari. It would appear, however, from Lieut. Boyd Alexander's observations (cf. this *Magazine*, vol. xxi. p. 599), that this change has been already accomplished. Of the affluents of the lake, only the Shari appears to be of any importance, for, according to M. Audoin, the Komadugu during seven months of the year presents only a series of disconnected basins. For the whole region a somewhat gloomy future is anticipated. The lake is apparently destined to ultimately become a marsh. The channels between the islands of the archipelago will soon become alkaline from evaporation, and the natives will be forced to travel westward in search of fresh water and fertile land. In other words, as new land is made towards the west the desert will encroach upon the east. M. Audoin sums up by saying that the French surveys of the last few years have disclosed nothing new in the Chad region; the recent observations only confirm and extend the older.

The Age of the Rhodesian Ruins.—In our account of the South African meeting of the British Association (vol. xxi. p. 651), mention was made of the views put forward by Mr. Randall MacIver as to the age of the Rhodesian Ruins. Mr. MacIver, as was then pointed out, considers that these are of much more recent age than has been supposed by other observers. In a paper read before the Anthropological Institute on December 5 (see *Nature*, December 28), he again discusses the question, and the following abstract of his paper may serve to further indicate the evidence upon which he relies in bringing forward his theory :—At Inyanga there are countless "pit dwellings," consisting of a pit and passage and hut platforms. The elucidation of the mystery of their use is assisted by a study of the Niekerk ruins, which are the most remarkable in the country. The area of these ruins is not less than fifty square miles, and within this area it is almost impossible to walk more than ten yards without coming upon a wall. The general principle appears to be that each hill constitutes a separate unit complete with its own buildings, and divided at the bottom from its neighbour by a boundary wall, which is the first of a series of concentric lines. These lines cannot have been for purposes of irrigation, but must have been entrenchments. They always cease at the crown of the hill, which is covered by a series of buildings, and it is this fact which shows the bearing of these walls on the problem of the pit dwellings. The buildings in the hill are of two types, one divided by successive stages from the pit dwelling, and the other the pit dwelling itself. The forts at Niekerk are also generally of similar or derived form to those at Inyanga. Similarly, the more advanced type of buildings found at Umtali or elsewhere are all derivatives of the pit dwelling, and Great Zimbabwe itself falls into line, and was simply a royal kraal. In the whole country there seems to be a regular progression with regard to these buildings, the northern region being the most fortified, and the defensive scheme becoming less rigorous towards the south. As to the builders of these forts and dwellings, all the implements found are of the type used by the natives of the present day, and as at Niekerk there is no evidence of modern squatting, it seems fair to presume that similar implements found elsewhere are also not the results of squatting, but were left by the original builders. As to the date, Mr. MacIver cut sections in the ruins he visited, and at Dhlo-Dhlo he made a most significant and conclusive discovery. A trench was cut below the intact cement floor of a hut, and amongst other objects Mr. MacIver discovered fragments of Nankin china. Consequently, no stone was laid at Dhlo-Dhlo before the time when Nankin china was manufactured and imported from the east; experts fix this date as the sixteenth century A.D. This find conclusively fixes the date for Dhlo-Dhlo, and all the other remains exhibit similar characteristics of building, and it may be taken as proved that the ruins of Rhodesia are mediæval or post-mediæval, that they cannot possibly be placed earlier than the eleventh century (probably the very oldest building was not erected before the fourteenth century), and that they were built by a native African race not differing to any great degree from the modern natives.

Recent Work on the Victoria Falls.—In a letter to *Nature* for November 23, Colonel H. W. Feilden gives some account of the Palæolithic implements to be found in the Zambesi Valley, in the vicinity of the Victoria Falls, and discusses the question of the relative age of these implements. The following interesting points which he brings out may be rendered clear by reference to the plan of the falls which appears in vol. xxi. p. 150 of this *Magazine*. The river, as this plan shows, is very wide above the falls, and is suddenly constricted as it is swept into the gorge to tear down the winding cañon, with its total length of forty miles. Above the falls it runs through a series of beds, called the desert sands by Colonel Feilden, at whose base is a bed of chalcedony and ferruginous sandstone, resting on basalt. It is in this chalcedony bed that the implements occur, and they are there in abundance. In the rain forest area, below the present falls, and on parts of the basalt promontories and platforms above the existing chasm, water-worn implements and pebbles from this chalcedony bed occur. The conclusion come to is, that the period when Palæolithic man inhabited the valley and made the implements was prior to the excavation of the present gorge and cañon. The Zambesi must then have flowed over what is now the rain forest area, through a deposit of desert sands, and had not then carved the great cañon out of the underlying basaltic beds. In other words, when Palæolithic man inhabited this region the Zambesi must have flowed about 500 feet above its present level in the area below the falls. If this hypothesis be correct, it obviously gives the geologist a possible means of calculating the approximate date of the Stone Age in South Africa by calculating the rate of retrocession of the falls.

In another issue of *Nature* (November 30), there is given an abstract of Mr. Lamplugh's report on the Falls to the Geological Section of the South African Meeting of the British Association (cf. this *Magazine*, vol. xxi. p. 648). The result of Mr. Lamplugh's investigations is to entirely confirm Mr. Molyneux's view (*Geographical Journal*, January 1905) that the falls and gorge are due to the erosive action of water, and not to a rift of the crust as was suggested by Livingstone.

America.

The Ownership of the Falkland Islands.—A somewhat violent article in the *Boletín del Instituto Geográfico Argentino* (xxii.) gives a historical account of the ownership of these islands since they were first taken possession of on behalf of Louis XVI. It appears that in the United States there has been some talk of purchasing the islands from the British Government, but the author of the article referred to is of opinion that they have always been, strictly speaking, the property of the Argentine.

The Flooding of the Paraguay.—A note in the *Boletín del Instituto Geográfico Argentino* (xxii.) discusses the periodical overflows of this mighty river. Every few years minor floods occur, doing a

certain amount of damage, but these are of relatively slight importance. Every now and again, however, there comes a flood of extraordinary violence and magnitude, and then the damage done is nothing short of an appalling disaster. Beginning with 1833 it is noted that these extraordinary floods have recurred in 1858, 1878, and during the past year. These figures point to a normal interval of from twenty to twenty-five years, and suggest that the next flood will occur in 1923 or 1925. The interval should allow time for a scientific investigation of the cause of the floods, and for the suggestion of some method of preventing or palliating a new disaster.

The Evolution of Argentina.—We have received a copy of the Buenos Ayres *Standard* for November 26, containing an account of an address under this title delivered by Mr. Herbert Gibson at the British Argentine Exhibition. In his address Mr. Gibson emphasises the fact that the republic is prepared to receive and settle 35,000,000 people, and pointed out how much land still awaits occupation and development. The area which is adapted for the cultivation of cotton alone is said to exceed the total area of the cotton States in North America. Mr. Gibson is of opinion that what is chiefly wanted is adequate means of making known the advantages which the Argentine has to offer to settlers.

Polar.

Mikkelsen's Arctic Expedition.—It is announced that Mr. Einar Mikkelsen has now obtained sufficient funds to carry out his proposed Arctic expedition. Some account of the expedition was given in our November issue (vol. xxi. p. 609), but in the January issue of the *Geographical Journal* there appears a statement by Mr. Mikkelsen of his plans, which shows that the earlier arrangements have been somewhat modified. It is now proposed that Mr. Mikkelsen's companions should start from Athabasca Landing in May for the mouth of the Mackenzie River, while the leader will go through Behring Strait in a whaler, and join the party probably about the latter part of August. The further plans are much as previously outlined, save that the rendezvous of the northern and supporting parties is given as Camden Bay, though, if possible, the exploring party may attempt to reach Wrangel Land. The exploring party intend to carry a simple form of sounding apparatus in order to learn something of the ocean floor. Mr. Mikkelsen left this country for the United States on January 20, in order to complete his arrangements.

New Maps of the South Polar Ocean.—Attention should be drawn to a most interesting bathymetrical map, showing the results of all the recent Antarctic Expeditions, which appears in *Petermann's Mitteilungen* (xi. 1905, p. 241). The map has been prepared by Dr. Gerhard Schott, who in the accompanying article gives a critical account of the work of the various expeditions, in so far as these bear upon the question of the form of the Antarctic Ocean. Dr. Schott's map differs in

a good many respects from that published with Mr. Bruce's article in our issue of last August, and a comparison of the two will be found very interesting. Further, as Dr. Schott's map covers the whole Antarctic area, instead of only a part, it is especially instructive in that it shows clearly the points which still await investigation.

Another new Antarctic map appears in the *Bulletin* of the American Geographical Society for November. The map is drawn by Dr. Hans Fisher, and is based upon the results of all the recent expeditions, including that of Dr. Charcot.

Scottish National Antarctic Expedition. The Silver Medal.—The accompanying illustration is a reproduction of the Silver Medal of the Scottish National Antarctic Expedition.

The medal has been given by Mr. William S. Bruce to the members of the expedition, including the captain, the members of the scientific staff, officers, and crew of the *Scotia*, as well as the home staff, who have served throughout the expedition, as a token of appreciation of the work done by them. The obverse side represents the terrestrial globe floating in space swathed in clouds, showing especially the Atlantic Ocean and the neighbouring American, European, African, and Antarctican continents—the scene of the labours of the expedition. Below is the ship beset in heavy ice off Coats Land in 74·1° South latitude, with a typical flat-topped Antarctic iceberg in the background. Encircling this design is the legend, "Scottish National Antarctic Expedition," with a figure of St. Andrew and the Cross. The reverse side represents Omond House, built specially by the officers and crew of the *Scotia* at Scotia Bay, South Orkneys, showing the beach and the adjacent mountains. Encircling this is a wreath of thistles supported by two flags—one the Scottish Lion, the other the St. Andrew Cross with the letters S.N.A.E.—the expedition flag. Above is a scroll bearing the inscription, "for Valuable Services" with the recipient's name. The dates 1902-1904 indicate the duration of the expedition.

The recipients are as follows :—

The Scientific Staff.—R. N. Rudmose Brown, B.Sc., Robert C. Mossman, F.R.S.E., J. H. Harvie Pirie, B.Sc., M.B., David W. Wilton.

Ship's Company.—Captain Thomas Robertson, *master*. Robert Davidson, *first mate*. John Fitchie, *second mate*. James MacDougall, *third mate*. Allan G. Ramsay, *chief engineer* (deceased). Henry Gravil, *second engineer*. Edwin Florence, *chief steward*. William Smith, *second steward*. William Murray, *cook*. Henry Anderson, Gilbert Kerr, William Martin, John Smith, Alexander Walker, *able seamen*. Alexander Duncan, David Low, *firemen*.

Home Staff.—James G. Ferrier, *secretary*. Thomas B. Whitson, C.A. Nan Anderson.

General.

The Exploration of the Indian Ocean.—A final letter from Mr. Percy Gardiner in *Nature* for December 21 completes the account of the progress of this expedition (cf. this *Magazine*, xxi. p. 664). It is dated from the Seychelles on October 28. The last letter left the party

SCOTTISH NATIONAL ANTARCTIC EXPEDITION

FOR VALUABLE SERVICES
1902
1904

at Coetivy, awaiting the return of the *Skylark* from the Seychelles. During her absence the fauna and flora of the land and the reef were investigated as thoroughly as possible. The island was found to be higher than any previously visited, having wind-blown sand-ridges and hills up to eighty feet above sea-level, arising on a flat coral reef. Although situated only about 130 miles to the south of Seychelles, the land flora and fauna of the island are as poor as those of the Chagos. The plants appear to be determined rather by the nature of the soil than by the proximity to continental land. On the other hand, the marine fauna of the reef is more varied than at the Chagos, while nearly every species found in the latter appears to be present. The eastward and seaward reef of the island was of rather different character from any previously observed, being covered by algæ, notably a grass-like form, locally called "varech," but the western reef closely resembled similarly situated reefs at the Chagos. Mr. Gardiner goes on to say :—

"Leaving Coetivy on September 25, the vessel proceeded to Farquhar Atoll, which, like all the reefs subsequently seen, proved to be covered with 'varech.' Its land attains a height of seventy feet, and is clearly of the same formation as Coetivy. It shows no trace of elevation. From Farquhar the expedition proceeded to sound between the chain of islands which extends between Madagascar and the Seychelles, and which would appear to indicate a line of former connection. Between Farquhar and Providence, thirty-two miles, we found 890 fathoms, and between the latter and Alphonse-François, one hundred and fifty-five miles, 2170 fathoms, while there were already soundings of 952 fathoms between Alphonse and the Amirante Group, forty-six miles, and of 1150 fathoms between the latter and the Seychelles, thirty-two miles. As the depth on either side is only about 2300 fathoms, any connecting ridge is comparatively low and of doubtful importance.

"Providence was particularly interesting, being simply a great reef, twenty-eight miles long by seven miles broad to the 100-fathom lines. Off it we took twelve dredgings, obtaining a rich fauna down to about 100 fathoms, below which the bottom was exceedingly barren of life. From one dredging at 744 fathoms, three miles to the west of the reef, we obtained about five cwt. of stones, the largest about two feet in diameter. We have here no means of properly ascertaining their nature, but similar rock has not, so far as we are aware, been hitherto described off any coral reef. It is almost entirely insoluble in acids, and is largely formed of different crystals, organic deposits practically not entering into its composition. Some masses looked like solidified ash or clay, while others appeared rather like volcanic bombs. All were more or less coated with manganese, but we do not know its thickness, preferring to keep the specimens intact for proper examination on our return to England. However, it is clear that the existence of this rock in such a position will have to be carefully considered in connection both with the formation of Providence Reef and with the existence of any former land connection between the Seychelles plateau and Madagascar.

"Pierre Island, seventeen miles to the west of Providence Reef, and with a depth of 1088 fathoms between, is peculiar in having no fringing

reef. It is simply an elevated coral island, reaching to a height at present of about thirty feet, surrounded by overhanging cliffs, so that landing is extremely difficult. Its rock is entirely coral.

"Alphonse and François are sandbanks on the rims of two reefs, scarcely two miles apart. Both reefs are of atoll formation, the lagoon of Alphonse (not shown in any chart) being 3 to 8 fathoms deep and of considerable size.

"The Amirante islands are likewise sandbanks, no parts of any being more than ten feet above the high-tide level. The hills represented in the separate enlarged plans of D'Arros, St. Joseph, and Desroches do not exist, and probably owe their presence thereon to the imagination of the draughtsman. Desroches is really an atoll by itself, lying ten miles to the east, and being separated by a channel 874 fathoms deep. The rest of the islands and reefs lie on a bank about fifty miles long by twenty miles broad, with an average depth of about 30 fathoms. Eleven separate reefs reach the surface, of which St. Joseph alone has a lagoon, being really a small atoll with about four fathoms of water in the centre. With the exception of Eagle, D'Arros, and Bertant, all the reefs lie on the edge of the bank, but its edge is in most places covered by at least 8 to 10 fathoms of water. Its slope is steeper than is customary off coral reefs, no possible dredging-ground existing between 60 and 500 fathoms.

"All the islands of the Amirante group, with the exception of Marie-Louise and Eagle, are now planted for cocoanut oil, but the indigenous vegetation still remains in places. The land plants and animals are almost the same as at Coetivy and in the Chagos, the additions due to the proximity of Africa and the Seychelles being relatively few. The marine fauna and flora were markedly richer than even at Coetivy.

"Of other work, we have taken about sixty dredgings off the islands we visited down to more than 800 fathoms, and tow-nettings at various depths to more than 1000 fathoms. We have consequently rich collections, but obviously no estimate of them can be at present formed. We have also serial temperatures in a series of positions, and water samples have been taken throughout down to various depths. Magnetic observations have also been secured at intervals along the line between Madagascar and the Seychelles."

The Geographical Association.—The annual meeting of this association was held on January 5 in the Medical Examination Hall, Victoria Embankment. Dr. C. R. Parkin (Secretary of the Rhodes Scholarship Trust) occupied the chair. The report stated that there had again been a steady increase in the number of members, there now being a total of 503. Among the members were teachers of every grade, school inspectors, and others interested in geographical education, both at home and abroad. One of the most important advances in the position of geography in our educational system had been made this year by the publication of new regulations by the Board of Education, in which a four years' course in geography was recommended for

secondary schools. The Board would recognise the teachers' own syllabus if it were approved. This was a very valuable step on the part of the Board of Education, and the association desired to express its thanks to the authorities who were responsible for it.

The chairman subsequently delivered an address on the importance of geography, and Mr. J. L. Holland opened a discussion on recent regulations and syllabuses affecting geography in elementary schools. Mr. J. F. Unstead also read a paper.

The Ninth Geographical Congress.—It is announced that the Ninth International Geographical Congress, which is to meet in 1908, is to be held in Geneva, and is to extend from July 27 to August 6. The last Congress, it will be remembered, was held in the United States in 1904.

The Teaching of Geography.—We have received the following copy of resolutions adopted by the Council of the Glasgow and West of Scotland Branch of the Teachers' Guild of Great Britain and Ireland:—

"1. That the importance and high educational value of the study of Geography are now generally admitted, and that the many new aspects it presents, affording as they do, wider scope for training and discipline, call for fuller recognition and improved methods of treatment in our Schools, Colleges, and Universities.

"2. That this Branch of the Teachers' Guild of Great Britain and Ireland respectfully desires, in common with other Educational Bodies, to represent to the Scotch Education Department that the time has now come for the application to Scotland of some such recommendations as those recently issued (Form 124) by the Board of Education, Whitehall, especially such as relate to Lesson-Periods and Courses of Study.

"3. That in written Examinations, whether held by the Scotch Education Department in connection with Leaving Certificates, or by University Preliminary Examination Bodies, a place of greater importance be assigned to the subject of Geography, and that the questions set test the all-round geographical intelligence of the candidates, rather than their verbal memory of names and isolated facts.

"4. That in each of the Scottish Universities there should be established a Chair of Geography and Commerce, with a fully equipped Department attached thereto, and that thereafter the Scotch Education Department, in combination with the Universities, be asked to provide such means of efficient instruction and training as shall lead to a satisfactory supply of specially qualified teachers of Geography.

"5. That, in the prosecution of the study of Geography, every facility be afforded pupils for undertaking, under proper supervision, systematic field work, excursions, factory visits, etc.

"6. That, by a service of Central Committees or otherwise, a common and definite understanding should be come to between the Scotch Education Department, Expert Geographers, Examiners, Teachers, and Book-publishers, as to the compiling and producing of text-books, atlases, maps, etc., best suited to advance the rational teaching of Geography."

The Mungo Park Centenary.—A committee has been formed in Selkirk to raise funds to celebrate the centenary of the death of the

famous explorer, Mungo Park. It is proposed that in the first instance the money subscribed should be used to add two bronze panels to the monument at Selkirk, and any surplus should go to the founding of a Mungo Park Bursary. Subscriptions should be sent to the hon. treasurer, Mr. Carnegie Alexander, Selkirk.

NEW BOOKS.

EUROPE.

Sweden for Peace. The Programme of Sweden in the Union Crisis. By NILS EDÉN, Professor at the University of Upsala. London: David Nutt. Pp. 40.

This pamphlet, written in calm and temperate language, sets forth historically in a very readable form the question of the separation of Sweden and Norway from the Swedish standpoint. The author makes it clear that Sweden never intended to go to war for the maintenance of the Union at any period of the negotiations between the two countries; and that throughout these negotiations Sweden, under circumstances very trying to her dignity, behaved with the utmost patience and self-restraint.

La Belgique: Institutions, Industrie, Commerce. Brussels: J. Goemaere, 1905. Pp. 870.

Presented to the Society by the Belgian Minister of Industry and Labour on the seventy-fifth anniversary of his country's independence, this beautifully illustrated volume gives the most complete and reliable account of Belgium that has perhaps ever been produced. In a series of exhaustive chapters, it furnishes official reports on the political and administrative organisation of Belgium, her system of public instruction, both primary and secondary, Belgian science, letters, and fine arts, agriculture, horticulture and arboriculture, forests, sport, fishing, and hygiene. Then we have chapters on industries connected with food, and on Belgian social economy, her middle classes, industrial and professional education, mining, metallurgy, mechanical construction, electrical industry, arms, glasswork, porcelain, chemicals, oils, soap and perfumery, textile industries, woodwork, tobacco, tanning, rubber, papermaking, printing, and the diamond industry. After this we find an account of Belgian commerce, ports, and navigable ways, railways and postal and telegraphic systems, concluding with a glance at Belgium's Ministry of Foreign Affairs, and articles on the Belgian army, missions, and on the Independent State of the Congo. Although a small country, with a population little in excess of Greater London, Belgium is a hive of industry, and a work like this testifies to the zeal and thoroughness with which her officials apply themselves to increasing her wealth and prosperity by the most efficient methods of administration.

A French authority declared that "Belgium is the laboratory of the social and political reforms of Europe." British economists have lately visited Belgium in search of some solution of the Unemployed problem. We extract from this official work a paragraph relating to this subject:—

"A distinction is made in Belgium between depôts of mendicity and houses of refuge. Vagrants who appear to be vicious and men of bad character are sent to the depôt of mendicity at Merxplas; while persons who are only unfortunate, and who give hope of regaining a position, are sent to the houses of refuge at Wortel and Hoogstraeten. On the same principles, women are sent to the depôt

of mendicity at Bruges, or to the refuge established in that town. These charitable institutions sheltered in 1900 a population of 5749 persons. Schools of charity, the depôts, and the refuges are under the control of a committee of inspection whose members are nominated by the King."

Place-Names of Ross and Cromarty. By W. J. Watson, M.A., Rector of Inverness Royal Academy. Inverness: The Northern Counties Printing Co. 1904.

This substantial volume has been hailed, and deservedly hailed, as the most important contribution to the study of Scottish place-names which has yet appeared. The author is a fully equipped Keltic scholar, who has taken immense pains to collect his material, not only from all the available records, but also by personal travel through all the length and breadth of Ross-shire's many vales and hills. In Lewis, however, he is chiefly indebted to Mr. Kenneth Mackenzie of Shader. In the study of Norse names he has done a good deal of pioneer work, and every future student—we trust there will be many—will obtain invaluable help from Mr. Watson. Each parish is dealt with by itself, and that, too, wellnigh exhaustively.

The chief fault to be found with the book, and it is a serious one, is the false air of finality which it wears. Mr. Watson speaks far too strongly about the regular and unbroken tradition (p. xxviii.) which has handed down to us all our modern Gaelic pronunciations of place-names. This regularity has many exceptions. The writer has noted thirty-three instances given by Mr. Watson himself, in which the present Gaelic pronunciation is mistaken or misleading. Had Mr. Watson told us all he knows, he could have trebled the number with ease. In the case of names of which the Gael does not know the meaning himself—chiefly non-Gaelic names—the Gael is most unreliable. Last summer the present writer got two quite different pronunciations of the same name from two natives in one farmyard. Mr. Watson omits many variant pronunciations and also variant etymologies, quite as noteworthy as his own, which he ought to give. Alness, Farness, Katewell, Urquhart, Wyvis, may be cited as cases in point. Mr. Watson has a boundless contempt for all native etymologies. One is glad to note that his confrère, Dr. Macbain, in his recent paper on *The Place-Names of Inverness-shire*, puts in a strong plea on their behalf, in such a case as Rothiemurchus. They are right, sometimes.

Mr. Watson also adds to the difficulty of the Sassenach's studies by the theoretical pedantry of his spellings, which Dr. Macbain is doing at least something to break down. One of the commonest of Keltic place-name endings is *-ie*, an old locative, as in Logie, Learnie, etc. It is bad enough to spell this, as most do, *-idh*, seeing that there is no trace of a *dh* either in the spoken tongue or in the oldest place-name records; it is worse to do as Mr. Watson does, and insist on spelling the sound *-ie* or *-y* as *-aidh*. He repeats this provoking habit in names like Alness and Farness, which he spells Alanais and Fearnais, though they are never so pronounced. The ending here is always pronounced, *and meant to be pronounced*, as *e*, not *ai*; and Alness has not the same ending in the native tongue as Wyvis, though Mr. Watson spells both *-ais*.

We have noted very few omissions in either book or index, which, we repeat, are very thorough pieces of work. But the writer was disappointed to find that no attempt is made to explain that puzzling name, the Minch. Mr. Watson tells us its Gaelic name is a' Mhaoil, or Cuan Sgith, "Sea of Skye." Curiously enough, the present writer failed to find any trace of a Gaelic name at all among the fishers of Loch Broom; and in Skye and the Long Island, the only name he could ascertain is Cuan Sgiathanach or Cuan Laodhasach, "Skye," or "Lewis

Sea." Perhaps Mr. Watson should include Skotland fjörðr, the Norse name for the Minch, as a name on record in the millennium after Ptolemy (p. xxxii.), otherwise so barren for Ross-shire names. As to the form Minch itself, it is probably a seaman's corruption, like St. Kilda. Probably some seaman mistook the Norse name *megin-nös*, "great ness," as applied to either Cape Wrath or the Butt of Lewis, and thought it meant the tossing sea between. We have, at any rate such compounds as *megin-land*, "mainland," and *megin-haf*, "the ocean.' *Megin-nös* would easily become Megin-nish, Min-nish, Minch. This is supported by such analogies as Mingarry and Minginish, both of which Dr. Macbain derives from *mikinn*, accusative masc. of *mikil*, "great." But *mikinn* is barred in the case of *nös*, which is a feminine and not a masculine substantive.

ASIA.

The Private Diary of Ananda Ranga Pillai. Translated from the Tamil by order of the Government of Madras, and edited by Sir J. Frederick Price, K.C.S.I., late of the Indian Civil Service. Vol. I. Madras: Printed by the Superintendent, Government Press, 1904.

The claims which this curious book has on our attention are only very indirectly connected with geography. The writer, Ananda Ranga Pillai, as we gather from the introduction by Sir J. Frederick Price, was a Madras merchant, born in the beginning of the eighteenth century, who in the year 1716 was brought by his father to Pondicherry, the headquarters of the French in India. At his father's death in 1726 he was taken up by M. Lenoir, the Governor, who appointed him head of the blue cloth factory at Porto Novo, and in this post he soon acquired and successfully retained the confidence both of M. Lenoir and of his successor, M. Dumas. Unfortunately in 1740 the factory at Porto Novo was utterly destroyed by the Mahrattas. In 1742 the famous Dupleix arrived as Governor of Pondicherry, and on the death of the chief *dubash* or *courtier* in 1747 he appointed Ananda Ranga Pillai in his room. From this time the author of this diary seems to have been a special favourite of Dupleix up to the end of 1754, when Dupleix was recalled to France in disgrace. In 1756 Ananda Ranga Pillai was removed from his office of *dubash*, and he died in 1761, just four days before the surrender of Pondicherry to Colonel, afterwards Sir Eyre, Coote.

With regard to the contents of this most interesting and amusing diary we cannot do better than transcribe for our readers the judicious appreciation of it by Sir J. Frederick Price: "It stands unique as a record of the inmost thoughts and reflections of an extremely able, level-headed Oriental, and of his criticisms—which at times are of the freest character—of his fellows and masters. It is a strange mixture of things trivial and important; of family affairs and matters of state; of business transactions and social life of the day, interspersed with scraps of gossip, all evidently recorded as they came to the mind of the diarist, who might well be dubbed the 'Indian Pepys.' Homely as is its diction, there are in it descriptions of men and things which are vividly lifelike, and passages which are startling; some in their pathos, and others in their shrewdness. As a record the diary, though perhaps in parts dull reading, is on the whole a deeply interesting, and probably valuable account of things historical, political, and social appertaining to the period embracing the rise, the zenith, and the beginning of the decline of the French power in India." The translation of this remarkable work is to be published in three volumes, of which the first, dealing with the events of the decade of 1736-46, is now before us. At the present time some of the descriptions of what went on two centuries ago in the capital of French India are of special

interest. For instance, here is a description of the Governor's visit to Kalapattai, one of the large factories: "The Governor, M. Dupleix, started this morning (20th February 1742) at half-past four on a visit to Kalapattai. This was his first outing after his arrival from Chandernagore, and it was of a striking character. The palanquin of the Governor went first. It was followed by a body of fifty soldiers, by palanquins, and four or five horses, and by Mattanja Pillai and me; and dancing-women, tom-toms, horns, drums, pipes, clarionets, and flags were in his train. In this magnificent array the party set out by moonlight. When they arrived at my choultry, twenty-one guns were fired; but without stopping there they went straight on to a tent pitched at Kalapattai. They halted there for an Indian hour (*i.e.* twenty minutes), and then returned to my choultry, where the Governor alighted under a salute of twenty-one guns, which was repeated when he sat down to refreshments, when he drank wine, and when he rose from table. The choultry was ornamented with leaf pavilions, and cords hung with garlands, mango leaves, etc. The whole day partook of the character of an imposing festival, and was indeed exhilarating."

An interesting notification by the Governor of Pondicherry is given in the following words: "The Supreme Council of Pondicherry, acting under instructions from the King of France, decrees on the 27th February 1741, and makes it known to all the white and black population of Pondicherry, that the consumption of intoxicating liquors should be discontinued as far as possible during the present emergency; it being known that the excessive drinking of these causes many diseases during the hot months of the year. Let it therefore be an imperative rule that any person, to whatsoever race he may belong, who sells or causes to be sold from the 1st March to the 1st September, brandy, liqueurs, rum, or other spirituous liquor, or who in any other way acts in contravention of this order, shall be punished with imprisonment for a year, and shall also be liable to a fine of 1000 pagodas (Rs. 3000). Let it not be thought that this is an idle command. It is intended to strictly enforce it. Any person, whether a Tamilian (*i.e.* caste Hindu), or a Pariah, or of any other class, who sells or gives spirituous liquor to a soldier or any other person, or who carries it for hire, shall, on proof thereof, be punished with whipping in the court-house, be branded on the right shoulder with the figure of a dog, and be driven beyond the bounds of the town."

These extracts are sufficient to show to our readers that Sir J. Frederick Price has not framed an unduly high estimate of this work, which we accordingly strongly recommend to the perusal of all of our readers who are interested in Indian history.

The Central Tian-Shan Mountains, 1902-1903. By Dr. Gottfried Merzbacher. Published under authority of the Royal Geographical Society. Pp. 294, with Map and 20 Photographic Illustrations. London: John Murray, 1905.

Central Asia is a part of the world over which stretch great mountain ranges that have not as yet been properly explored or correctly mapped. One of these is the Tian-Shan, between Lake Issik Kul and Eastern Turkestan, the highest peak of which, Tengri Khan, rises to a height of over 23,000 feet. The area has been traversed and partly explored by Russian travellers, and the results of their work is incorporated on a map to the scale of 40 versts to an inch. But this map is very defective and inaccurate; the place-names are not always correctly recorded, and great natural features such as lateral valleys are entirely omitted. Even Tengri Khan itself is misplaced, and its name transferred to another peak. To amend the map and to explore and delineate as scientifically as possible the Central Tian-Shan was the enterprise that Dr. Merzbacher set forth to accomplish.

For this task he was specially well fitted, and the result is a volume full of interest for the geographer and the geologist. A book of travels is usually replete with incidents of the traveller's personal discomfort, recorded in such a way as to excite, if possible, the sympathy of the reader. But here nearly all such details are omitted, and it is more by reading between the lines that we form an idea of the magnitude of the dangers, annoyances, and discomfort the author had to endure in carrying out his plans. More than half the work lay on icefields, while exploring and surveying, both topographically and geologically, the series of huge glaciers which radiate from the central mass of Tengri Khan. To obtain good panoramic photographs the author thought nothing of ascending mountain tops of 14,000 and 15,000 feet, and on at least one occasion, after having done so, a sudden change of weather accompanied by mist and fog robbed him in a moment of the fruits of his labour. And on his return to Kashgar at the end of the first season, through the carelessness of a servant while crossing a river, all the photographs and the telephotographic panorama of the glacier ranges of the Tian Shan, taken from the top of a mountain 13,800 feet high, fell into the water and were irreparably lost.

The author found that the central mass of the Tian-Shan is not, as was believed, composed of crystalline rock, but of metamorphic limestone and schist. It seems to be the core of a colossal anticlinal that formerly existed, the crown of which is the top of Tengri Khan. One of the glaciers, the Mylchik, which radiates from the central *massif* in a westerly direction, was found to have a length of from forty-three to forty-six miles; on the Russian map it is only allowed the moderate length of about nine miles. With one exception none of the glaciers show any sign of recent retreat, and the author believes there is no danger of the complete drying up of Tian Shan as has been frequently foretold.

In the course of two seasons' work the author surveyed most of the glacier valleys on the west and north of the central range, and brought home two thousand photographs, including a continuous panoramic view of about half of the perimeter of the entire range. A large number of geological specimens and fossils were collected, which, when identified and arranged, will be described in a future work; botanical and zoological specimens were also not neglected, though the collection of them was only a secondary object. On the whole, Dr. Merzbacher is to be congratulated on having performed a first-rate piece of work in a successful manner, under very trying circumstances.

AFRICA.

The World of To-day.—Vol. III. Africa. By A. R. Hope Moncrieff. London: Gresham Publishing Co., 1905. Pp. vi + 280. Numerous Illustrations and Maps.

It is no easy task to compress the survey of a large field into small compass, and at the same time to retain the interest of the reader. But Mr. Hope Moncrieff is to be congratulated upon the distinct success which he has attained in achieving this double object. His work shows wide knowledge and reading (not confined to our own language), and a special feature of the book seems to us those footnotes in which he gives a précis of such incidents as the expedition led by Baden-Powell against Coomassie, the rise and fall of the Mahdi, and the story of the relations of the English and Dutch in South Africa. They are admirable specimens of such writing.

The author begins his book with a most readable account of the Nile lands and Abyssinia, then describes the picturesque Barbary States and the Atlantic Islands, next the Sahara and Soudan region, the great area of Central Africa, and

lastly South Africa. The work, however, is by no means confined to Physical Geography, though the main features of the Continent in this respect are well brought out. It does justice also to its historical, ethnographical, and commercial aspects. In this connection attention may be drawn to the excellent appendix with its numerous diagrams, which display in graphic form the results of extensive research. Indeed, it is remarkable what an amount of useful information has been compressed within the 280 pages of the volume. The illustrations, both plain and coloured, add greatly to the attractiveness of the book, which is in all respects admirably produced.

AMERICA.

Back to Sunny Seas. By Frank T. Bullen, F.R.G.S. London: Smith, Elder and Co., 1905.

The Sunny Seas described in this book are those of the West Indies, and certainly the most prominent feature of the voyage as depicted by Mr. Bullen was the terrific heat. The author wisely disclaims any intention of writing a guide-book; the work is in fact a panegyric of the delights of a somewhat lazy life on board some of the best ships which ply between England and the West Indies. Mr. Bullen, as readers of his other works know, is in his element in describing scenery, and he waxes enthusiastic and eloquent in many pages of this volume. We gather that, on the whole, he was quite happy so long as he was on board ship, and while he was the guest of friends on shore; but his descriptions of the dirt and squalor, the insects, the diseases, and the degraded life of the inhabitants of many places he visited, are gruesome reading, and are not calculated to induce people to follow his example by making the tour. The book contains eight coloured illustrations by Mr. Forrest, R.I.

GENERAL.

The Oxford Geographies. Vol. II.: The Junior Geography. By A. J. Herbertson, M.A., Ph.D. Oxford: At the Clarendon Press, 1905.

When it is stated that the Junior Geography for students going up for the Oxford Junior Local Examinations has been prepared by Dr. Herbertson, that is a sufficient guarantee for careful accuracy and scholarly work. The book is equipped with 166 illustrations or figures, the most of which have been specially drawn for the work.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

The Re-Shaping of the Far East. By B. L. Putnam Weale. 2 vols. Demy 8vo. Pp. xxvii + 1072. *Price* 25*s. net.* London: Macmillan and Co., 1905.

Through Five Republics of South America. By Percy F. Martin, F.R.G.S. Demy 8vo. Pp. xxiv + 487. London: William Heinemann, 1905.

Greek Life in Town and Country. By W. Miller. Crown 8vo. Pp. x + 311. *Price* 3*s.* 6*d. net.* London: George Newnes, Ltd., 1905.

Baku: An Eventful History. By J. D. Henry. Demy 8vo. Pp. xviii + 256. *Price* 12*s.* 6*d. net.* London: Archibald Constable and Co., 1906.

Village, Town, and Jungle Life in India. By A. C. Newcombe. Demy 8vo. Pp. x + 417. *Price* 12*s.* 6*d. net.* Edinburgh: Wm. Blackwood, 1905.

In the Heart of the Canadian Rockies. By James Outram. Demy 8vo. Pp. xii + 466. *Price* 12*s.* 6*d. net.* New York: Macmillan and Co., 1905.

Philippine Life in Town and Country. By James A. Le Roy. Crown 8vo. Pp. x + 304. *Price* 3*s.* 6*d. net.* London: G. P. Putnam's Sons, 1906.

The St. Lawrence River: Historical, Legendary, Picturesque. By George Waldo Browne. Medium 8vo. Pp. xix + 465. *Price* 15*s.* London: G. P. Putnam's Sons, 1905.

Java: Facts and Fancies. By Augusta De Wit. With 160 Illustrations. Demy 8vo. Pp. 332. *Price* 14*s. net.* London: Chapman and Hall, 1905.

New Egypt. By A. B. De Guerville. Demy 8vo. Pp. xiv + 360. *Price* 16*s. net.* London: Wm. Heinemann, 1905.

Nature through Microscope and Camera. By Richard Kerr, F.G.S., F.R.A.S. Demy 8vo. Pp. 197. *Price* 6*s. net.* London: Religious Tract Society, 1905.

The World of To-day. By A. R. Hope-Moncrieff. Volume iv. Pp. vi + 266. Royal 8vo. *Price* 8*s. net.* London: The Gresham Publishing Co., 1905.

The Harmsworth Encyclopædia: Everybody's Book of Reference. Containing 50,000 Articles profusely illustrated. Vols. i-iii. Edinburgh: Thos. Nelson and Son, 1905.

Hints for Meteorological Observers. By W. Marriott., F.R.Met.Soc. Sixth Edition. Demy 8vo. Pp. 69. *Price* 1*s.* 6*d.* London: Edward Stanford, 1905.

Ergebnisse der Untersuchung der Hochwasserverhältnisse im Deutschen Rheingebiet. Heft vii. Das Moselgebiet. Bearbeitet von Dr. M. von Tein. Berlin: Wilhelm Ernst und Sohn, 1905.

Life in Morocco. By Budgett Meakin. Demy 8vo. Pp. viii + 234. *Price* 12*s.* 6*d. net.* London: Chatto and Windus, 1906.

Also the following Reports, etc.:—

Whitaker's Almanack for the Year 1906. *Price* 2*s.* 6*d. net.*

Whitaker's Peerage for the Year 1906. *Price* 3*s.* 6*d. net.* London: J. Whitaker and Sons, Ltd., 1906.

Martin's Tables; or, "One Language in Commerce," containing Tables and Information upon Imperial, Metric, Indian, and Colonial Measures and Weights. By Alfred J. Martin. Foolscap 8vo. Pp. xiv + 271. *Price* 2*s.* 6*d.* London: T. Fisher Unwin, 1906.

Rainfall of India. Fourteenth Year. 1904. Calcutta, 1905.

Report on the Administration of Burma for the Year 1904-5. Rangoon, 1905.

Meteorology of Mysore for 1904. Twelfth Annual Report. By John Cook, M.A., F.R.S.E. Bangalore, 1905.

Report concerning Canadian Archives for the Year 1904. Ottawa, 1905.

Sudan Almanac, 1906. Compiled in the Intelligence Department. Pp. 64. *Price* 1*s.* Cairo, 1905.

The Science Year-Book, Diary, Directory, and Scientific Summary, 1906. Edited by Major B. F. S. Baden-Powell. Demy 8vo. Pp. 364. *Price* 5*s. net.* London, W.C.: King, Sell, and Olding, Ltd., 1906.

Report on the Administration of Coorg for the Year 1904-1905. Mercara, 1905.

Report of the Eighth International Geographic Congress held in the United States, 1904. Demy 8vo. Pp. 1064. Washington, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

PLATE I. Platform of Lewisian Gneiss in Sutherland, with outliers of Torridon Sandstone resting on it : Suilven to the left.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE HISTORY OF THE GEOGRAPHY OF SCOTLAND.[1]

By Sir Archibald Geikie, D.C.L., LL.D., F.R.S.

(With Maps and Illustrations.)

Although it is now common knowledge that, in every quarter of the globe, the present dry land is not part of the primeval surface of our planet, but has been gradually built up in the long course of time, there are perhaps few, even among professed geographers, who realise by what a complicated series of terrestrial revolutions, and through what an enormously protracted succession of ages, the topography of to-day has been reached. Yet there can be no doubt that, in proportion as we comprehend and appreciate this gigantic process of evolution, our geographical conceptions become widened and vivified. We are led to perceive that every feature of a landscape is a memorial of some remote episode in the bygone history of the globe, that land and sea have often changed places, and that only after a lengthened chain of geographical vicissitudes has the dry land been fashioned into its existing forms. Our interest in the familiar scenery of a country is heightened by the recognition that it affords us a legible record of these terrestrial changes, and our imagination is kindled by the succession of mental pictures which the contemplation of this record supplies, and by the contrasts thus revealed between what has been and what now is.

It has seemed to me that it might not be inappropriate on the

[1] An Address delivered before the Society in Edinburgh on December 12, 1905. For the eleven plates illustrating the address the Author is indebted to the Director of the Geological Survey, who kindly allowed him to reproduce photographs taken by the staff of the Survey. The accompanying maps have been executed by Mr. J. G. Bartholomew after the Author's tracings, and some suggestions from Dr. B. N. Peach, F.R.S.

present occasion, when a geologist has been honoured by a Society of geographers, if I were to attempt to sketch, in broadest outline, the long series of geographical events which has finally resulted in the Scotland which we love and to which we are so proud to belong. While every country furnishes its own more or less full and varied version of the story, this country is singularly rich in its geological records. These bring before us a complicated succession of terrestrial revolutions, going back to the dawn of geological history and coming down to our own day. They do not, however, furnish a complete chronicle of all the changes which the region has undergone. In the course of the alternations of land and sea, large portions of the record have either never been inscribed, or have since been destroyed. Chapter after chapter has been, as it were, torn out by the ruthless hand of time. Yet though we may be unable to frame a continuous narrative, we can at least be sure of the sequence of the portions of the record that remain. And these are, for the most part, ample enough to supply materials for many discourses. Within the limited time available this evening I can only refer to some of the more salient and important parts of the history, particularly to those which have been most effective in their contributions to the present structure and configuration of the country.

Let me say, at the outset, that in tracing the gradual development of the geography of any portion of the earth's surface, we contemplate the working of two great antagonistic activities of Nature. Of these, the one arises from the pervading influence of the sun upon the outer envelopes of the globe; the other springs from the planet's own source of energy in its internal heat. With regard to the first of these two groups of forces, it is now a familiar truth that in every country and under every variety of climate, the dry land undergoes continual decay and consequent degradation. By changes of temperature from noon to night, and from season to season; by the transporting power of wind; by alternate soaking with wet and drying with sun-heat; by the washing of rain; by the erosion of torrents and rivers; by the disruptive action of frost; by the grinding and abrading work of ice; by the varied influences of plant and animal life; and by the gnawing action of the waves and currents of the sea, the rocks and soils of a land-surface suffer continual disintegration, and their loosened particles are transported by brooks and rivers to the sea. Every stream that is darkened with sediment is a visible witness of this waste; and not only a witness, but also a measure; for if the amount of sediment removed in a given time from a drainage-basin to the sea be ascertained even approximately, some estimate can be formed of the extent to which the surface of the basin is lowered by the removal. From calculations of this nature it has been found that in the course of periods of time, which, in the geological history of the globe, must be considered to be comparatively short, the dry land will be worn down to the level of the sea. Every part of the terrestrial surface which rises above that level is exposed to the universal degradation, and not until a tract of ground has been lowered beneath the limit of the effective action of the waves of the sea will it remain protected from further waste. Thus the ultimate fate of every portion

PLATE II.—Leagach, West Ross-shire—a mountain of Torridon Sandstone, with a capping of white quartzite.

of the land is to be reduced to a plain, and finally to be submerged under the sea, unless the process of demolition is arrested or counteracted.

With respect to the second type of activities, which arise from the operation of our planet's own internal energy, it may be said briefly that the secular cooling and contraction of the globe have powerfully affected the consolidated exterior shell. The terrestrial crust has been plicated and corrugated, fractured and displaced; some portions of it have been thrust upward, others have sunk down. From time to time, mountain-chains have been ridged up, and broad tracts of sea-floor have been raised into land, while, on the other hand, wide regions of land have been submerged beneath the sea. Over most of the globe a connection has at intervals been established between the molten material within the earth and the outer surface, giving rise to volcanic vents, both on the sea-bottom and on the land, whence gases and lava have been copiously discharged. These various subterranean operations manifest themselves for the most part only occasionally, sometimes in paroxysms of vigour, such as those that have produced the great mountain-systems of the globe, sometimes in slow and widespread movements of upheaval or depression. The subaerial waste, on the other hand, goes on incessantly. No sooner does a new tract of land rise above sea-level, than it is at once attacked by the great army of denuding agents, and unless the underground forces intervene to compensate for the waste, it is ultimately destroyed.

The history of the geographical features of a country is thus the chronicle of a long-continued warfare between these two great groups of natural forces—a record of persistent destruction and renovation, during which land and sea may seem to have been so constantly changing places, as to produce in the mind a first impression of endless repetition and excessive instability. We are apt to forget, however, that while the evidence is often clear and striking as to the reality and character of the ancient revolutions, it frequently fails altogether to reveal the vastness of the intervals of time whereby these events were separated from each other. Consequently, it becomes especially needful to endeavour to realise that these unrecorded intervals may constitute by far the greater part of the time whose history we seek to explore. There is no lesson which the geologist takes longer to learn than an adequate appreciation of the chronological significance of the gaps in his chronicle. And if to him this is a serious difficulty, it will be understood how still more perplexing it must be to others. In sketching the succession of the chief phases of geological history, to which the building up of this country is to be assigned, I must ask you to remember that though the events must necessarily rapidly follow each other in the narrative, they took place at widely separated intervals, and that these intervals were, often or generally, vastly longer than the time taken by the events on which our attention is chiefly concentrated.

I. By a fortunate series of accidents there has been preserved in the north-west of Scotland a portion of the oldest-known landscape of Europe. So ancient is this fragment as to date back to a time before the earliest-recorded traces of living things had appeared upon the surface of the earth. If any vegetation clothed that land, and if any forms of

animal life lived in the sea, they must have been of still more primitive types than the oldest fossils that have hitherto been discovered. And yet, surprising as it may seem, amidst a history so full of revolutions, some of the mountains and valleys of that primeval land have actually survived all the long series of destructions through which the surface of the country has since passed. They have survived, however, only because, while still part of the land, they were submerged and buried under thousands of feet of sediment, and so remained covered up and protected until, at a comparatively recent time, by the removal of the overlying mantle of sandstone, they were once more laid bare.

This interesting and venerable scenery was formed out of various igneous rocks which are known under the general name of Lewisian Gneiss. Even in those remote times, the forces of denudation acted as they do still, and the gneiss was carved into hills and valleys, which

FIG. 1.—North side of Quinaig, Assynt, Sutherland, showing an ancient hill capped with horizontal Torridon Sandstone which has filled up an old valley to the left.

after an entombment lasting from almost the beginning of geological history, are now being restored to the light of the sun. It is along the western borders of Sutherland and Ross-shire that this fossil landscape may be seen, more especially in the wild and rugged district between the head of Loch Maree and Little Loch Broom. Some of the hills, thus once more exposed to view, rise 2000 feet or more above the valleys that were scooped out of their flanks, the deep sandstone covering having there been stripped away both from the heights and the hollows. Further north the gneiss country was worn down into a broad plateau which stretched beyond Cape Wrath. It may be inferred that this ancient topography extended westwards into what is now the chain of the Outer Hebrides, and may even have stretched northwards into Norway. How far it went towards the south cannot now be discovered, for in that direction it still lies concealed under an enormous thickness of younger formations. There can be no doubt that, in these half-buried north-western hills, we see a portion of the first nucleus of the future

PLATE III. Arkle from Loch Stack. The lower half of the mountain, and the intervening ground down to the lake consists of Lewisian Gneiss; the upper part of the mountain is white quartzite.

Britain—the foundation-stone on which the whole complex superstructure of these islands has been built.

Not only have parts of this primeval land been preserved; we can still mark the shores of the sea or lake out of which it rose, and trace the area of that sheet of water within the bounds of Scotland for a distance of about 170 miles from south to north, and 60 miles from east to west (Map I.). So well defined are some of these shore-lines along the sides of the hills, that one may walk with one foot on the gravelly beach, and the other on the dry ground that rose above it. As the shore-gravel can be followed, ledge above ledge, up the mountain slopes, it becomes evident that the land subsided, and the water rose higher and yet higher on these declivities, until even the summits were submerged. In this water red sand and gravel gathered over the bottom until a thickness of 8000 or 10,000 feet of such sediment was accumulated, and the old landscape was deeply buried under it. I know no more impressive scene in the geology of our islands than these proofs of how a land-surface slowly vanished out of sight.

The sediments that gathered over the sinking hills and valleys afford a glimpse of some of the geographical conditions of the time. They show that rain fell and left its prints on the soft shore-mud, that wind blew the water into gentle undulations which rippled the sand on the bottom, that torrents swept the detritus of the hills into the water, and that waves plashed along the beach and rounded the detritus into gravel. Some of these littoral accumulations, however, are less easily explained —such, for instance, as the piles of coarse breccia which are here and there to be seen. Possibly these may indicate a somewhat arid climate, with a great range of temperature between day and night, and a consequent rapid breaking up of the rocks at the surface. On the other hand, the presence of large stones in the breccia, which must have been carried for several miles from their source, and the rounded domes into which the underlying gneiss has been worn, have suggested that possibly, even in this extremely ancient period in the earth's history, ice-action may have played its part among the agencies of denudation. This suggestion, which was made many years ago, is perhaps worthy of further consideration in connection with the evidence since adduced on this subject from some ancient rocks in Scandinavia, South Africa, Australia, and China.

The red sandstone and conglomerate, under which the earliest land-surface has been buried, form one of the most conspicuous geological formations of the north-west Highlands, which stretches as an interrupted belt from the cliffs of Cape Wrath, along the borders of Sutherland and Ross, and down the chain of the Inner Hebrides. It forms the second great mass of rock contributed towards the building up of Scotland. From its development around Loch Torridon, it has been named the Torridonian formation. To its structure and colour some of the most distinctive features in the scenery of these northern counties are due—isolated pyramidal mountains (Fig. 2 and Plates I. and II.), with steep fronts and deeply trenched corries, along the cliffs of which the level lines of stratification recall the courses of masonry in some colossal type of human architecture. But besides the considerable masses of the

formation which rise into these conspicuous hills, there is reason to believe that the Torridonian rocks have furnished not a little of the material which, as the result of later terrestrial movements, has been crushed and kneaded together to form the mountains of the northern Highlands.

II. From the old gneiss country and the Torridonian sediments under which it was buried, we pass to a consideration of the next picture revealed to us by the geological record. And here we encounter one of the gaps in that record, to which I have already referred. No evidence remains to show what happened after the last layers of the Torridon Sandstone had been laid down. Eventually, the floor of the sea or lake wherein that formation accumulated was upraised unequally, and some parts of it were ridged up into land. But over how wide an area this geographical change took place must remain unknown. We can form perhaps some probable idea of the general aspect of this new land—the

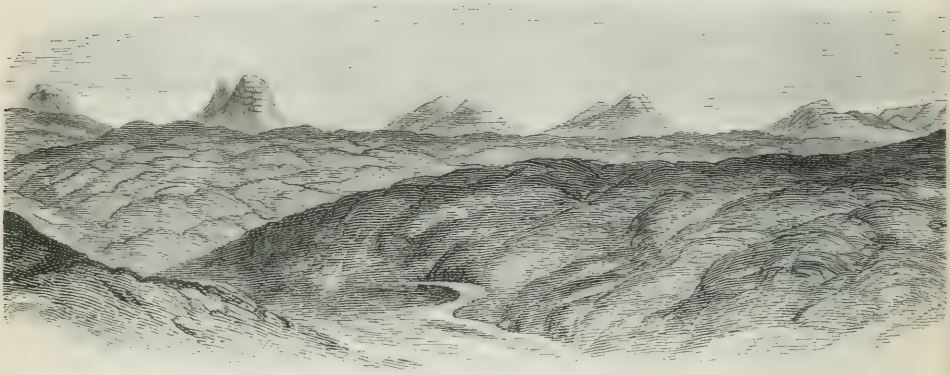

FIG. 2.—Portion of the ancient Gneiss platform, capped with isolated mountains of the Torridon Sandstone which once spread continuously over the whole region.

second which appeared in the development of the country—from what can be traced among the mountains of the north-west Highlands. As the sandstones had been uplifted over wide tracts without serious disturbance of their flatness, they probably formed a tableland which, if we may identify these strata with the sparagmite of Norway, not impossibly extended as far north as Scandinavia. But whatever may have been its outer form, this land certainly was exposed for an enormous interval of time to the influences of denudation. Like the hills of Applecross, which may represent its general features (Plate II.), it was deeply trenched with valleys, and suffered so prolonged a degradation that in some places the whole of the 8000 or 10,000 feet of Torridonian rock were worn away, so that once more the old gneiss below was laid bare (Plate III.).[1]

[1] In Plate III. the Torridonian formation is seen to have been entirely removed, and the gneiss to have been reduced to a plane surface on which the quartzite rests directly. The line of unconformable junction between these two rocks is well marked along the base of the screes of white débris.

PLATE IV.—Meall a Ghubhais, Ben Eay, Ross-shire a mountain consisting mainly of more ancient rocks which have been pushed over the Cambrian formations along the thrust-plane, indicated by the feature between the two arrows.

An indication of the length of time which these events required for their accomplishment is supplied by another kind of evidence. Hitherto, in the gradual building up of the framework of the country, none of the rocks afford any evidence that plant or animal life existed in the region. But the sea which now washed the shores of the Torridonian land teemed with living things. And these included representatives of types, such as the cephalopods, so highly organised as to point to an exceedingly remote ancestry. The remains of this fauna, which is known as that of the Cambrian period, has been abundantly preserved in the marine sands and calcareous ooze that were now laid down on the submerged flanks of the Torridonian tableland. Though generally comparable with the organic remains found in the Cambrian formations of other regions, these fossils of the north-west of Scotland possess a special geographical interest. They differ considerably from those found in corresponding strata in England and Wales, in Scandinavia, and in the rest of Europe. On the other hand, they find their nearest kindred in the fauna of the oldest fossiliferous rocks of Canada and the Eastern States. It would thus appear probable that, at this remote period in the history of the globe, open water lay between the north-west of Scotland and the east of North America, so that the same species of organisms could freely migrate between the two regions; but that the Scottish sea was shut off from ready communication with those northern and eastern waters in which the Cambrian fauna of the rest of Europe flourished. (Map II.) It is not improbable that the land-barrier thus indicated consisted in part at least of the Torridonian tableland. But it did not continue to maintain its position, for it gradually disappeared, partly by being worn down through the action of the denuding agents, but chiefly, no doubt, because it subsided into the Cambrian Sea. To what extent this downward movement reached cannot now be ascertained, for here again one of the great blanks in geological history presents itself. We know that the subsidence must have reached at least to 2000 feet, for such is the depth of Cambrian strata still visible in the north of Sutherland. But there can hardly be any doubt that it far exceeded that amount, and that the Scottish portion of the Torridonian tableland was buried under a deep covering of Cambrian, and possibly even of Silurian, sediments. Be this as it may, the white quartzites and grey limestones which enter as such conspicuous features into the scenery of the north-west Highlands must be regarded as the third vast pile of solid rock added to the bulk of the future Scotland (Plate III.).

III. In the progress of the geographical evolution which up to this point we have traced, the subterranean movements have been mainly of the secular or regional kind, wherein wide tracts of the land or of the sea-bottom were upraised or depressed, perhaps with extreme slowness, and, so far as appears, without, on the whole, any serious disruption of the terrestrial crust. Even now, in spite of all the revolutions of the geological past, the Torridon sandstones remain for many miles as horizontal as when first deposited (Fig. 1 and Plate II.). They have been equably uplifted and as equably depressed, though, here and there, they may have been fractured and even plicated. In our survey of the history

of events, however, we now reach a time when these gentle movements gave place to one of great extent and of stupendous violence. The crust of the earth was folded, ruptured and displaced, on a scale of magnitude to which there has been no parallel in the subsequent history of north-western Europe. In this, the earliest period of true mountain-making of which this country affords any record, a gigantic pressure was directed from south-east towards north-west, across the region of the north-western Highlands, slice after slice of the solid crust of the earth was torn up and driven onwards, portions of the ancient Lewisian gneiss, sometimes many square miles in area, were thus uprooted from the depths at which they had so long lain, and were pushed westwards so as to be piled high above the Cambrian strata (Plate IV.).[1] It may afford an idea of the scale of these displacements to know that some of the moved masses were thrust forward for a distance of ten miles or more.

How far in an easterly direction these gigantic plications and ruptures of the solid crust of the globe extended will never be known. They probably affected not only the whole of the central and eastern Highlands, but much of the rest of the British Isles, and they were prolonged, perhaps on an even more colossal scale, through the Scandinavian peninsula. But fortunately, within the bounds of Scotland, evidence is to be found of their western limit. From Cape Wrath down the extreme western margin of Sutherland and Ross to Skye and Rum, a belt of ground can be traced which appears to have remained unmoved by the tumultuous disturbance further east. It acted as a kind of solid breakwater, against which the earth-waves of the agitated terrestrial crust spent their force, and over which they piled the wreck of stone which they carried with them. Disencumbered of this overlying pile by the action of denudation, the higher parts of the steadfast barrier now rise into the great cones of Quinaig, Suilven, An Teallach, Slioch and the mountains of Torridon and Applecross (Plates I. and II. and Fig. 2).

The effects of these powerful subterranean movements are conspicuously displayed all over the Highlands. The rocks have been crushed, corrugated and rendered crystalline, until what was originally only so much soft mud and sand on the sea-floor has been changed, over a space of many thousand square miles, into the solid enduring materials out of which the Highland hills and glens have been carved (Plate V.).[2] The internal structures displayed by these materials are those characteristic of the rocks in the central parts of mountain-chains. We may legitimately infer that, as a result of the vast and prolonged disturbances, a mountain range was upheaved on the north-west of Europe, which, with a width greater than that of the mainland of Scotland, stretched

[1] The mountain shown in this illustration consists of a mass of Lewisian gneiss, Torridon Sandstone, and Cambrian strata, which has been driven westwards along a thrust-plane the outcrop of which is here well-marked. The rocks below this plane are Cambrian quartzites and shales, including the *Olenellus*-zone.

[2] In this illustration an intrusive sheet or sill of epidiorite is seen to have been first sheared into parallel layers which have subsequently been violently crumpled. The scale of these foldings is indicated by the hammer.

PLATE V.—Plication of the Highland rocks—Ben Vrackie.

PLATE VI.—The Highland Tableland—Mountains of Athol seen from beyond the River Tilt.

for 1600 miles from the west of Ireland through Scotland and Scandinavia to the Arctic Sea. Of this great range the present lands are the mere abraded fragments.

No evidence remains to warrant a restoration of the height and general aspect of this high ground when it first arose, or when it had reached the climax of its production. We may be tolerably confident, however, that it bore but little resemblance to what remains of it, either in Scotland or in Norway. These countries probably possess not a single vestige of its pristine surface. The present mountains have come into existence, not as the direct consequence of the earth-throes that uplifted the original range, but as the result of prolonged and enormous denudation. Ever since its birth this north-western range of Alps has been wasted by the subaerial agencies of destruction, until it has been cut down to the very roots. Glens and straths have been carved out of it by the streams that flow in them, leaving the ridges to stand up between. In this protracted process of sculpture every leading variety of rock and structure has yielded in its own peculiar way to the operation of nature's tools, and hence have arisen the local distinctions of scenery which give such variety and charm to the Highland landscapes.

When we contemplate the great antiquity of this mass of high ground, and the vast period of time during which it has been exposed to denudation, we may well wonder that so much of it still exists. Indeed its survival can perhaps hardly be explained save on the supposition that, not once only, but again and again, large portions of its area were worn down to sea-level and may have remained for long intervals as submarine plains, protected by the overlying water from further erosion. If the submergence was deep enough, these submarine platforms may have received a covering of sedimentary deposits, which, on the re-elevation of the sea-floor into land, would for a time protect the older rocks underneath from abrasion. Traces of such platforms of the crystalline rocks seem to be presented by the flat summits of the Eastern Grampians (Plate VI.), and by the broad fjelds that bear the snowfields of southern Norway. And that to some extent, at least, they were overspread and screened by a covering of younger formations, is proved by the detached outliers of these formations which are still left.

The underground movements which we have been here considering, though they may have rapidly reached their culminating stage of intensity, did not then cease. On the contrary, there is evidence of their continuance, with long intervals of quietude, during many subsequent ages. They began in the Cambrian or possibly in some early part of the Silurian period; but they certainly were vigorous at intervals during and towards the close of Silurian time, and during, as well as atter, the era of the Old Red Sandstone. To some of their later manifestations we owe the plication of the Silurian rocks which has given us the chain of the southern uplands from Portpatrick to St. Abb's Head. It is among these crumpled rocks that the remains of the earliest Scottish volcanoes have been preserved (Map III.). These vents were active in Lower Silurian time over the floor of the sea which then spread across the south of Scotland and the greater part of England and Ireland.

IV. Among the later subterranean movements in the series to which I have just referred, one possesses considerable interest in regard to the building up of the framework of the country. On either side of the central Highlands, the terrestrial crust was so folded as to form wide and long depressions which became the basins of extensive lakes (Map IV.). One of these sheets of water lay along what is now the great midland valley between the Highlands and Southern Uplands, and stretched into the north of Ireland. Another lay over the site of the west of Argyllshire, in the district of Lorne and Glencoe. The largest of the whole extended from the northern base of the Highlands across the area of the modern Moray Firth to beyond the Orkney and Shetland

Fig. 3.—Hill of gently inclined Old Red Sandstone, near Uam Var, on the Highland border. The denuded edges of the gently inclined strata show that the Old Red Sandstone once stretched to the right into the Highlands.

Isles. In these basins, the detritus washed down from the surrounding land accumulated to a depth of many thousand feet and formed the mass of strata to which the name of Old Red Sandstone has been given, and which underlies many lowland tracts, such as the great plain of Strathmore, and rises into some broad uplands, like the Braes of Doune.

A remarkable feature of these lakes was the number and vigour of the volcanoes which rose from their floors. Some of the eruptive vents poured out lavas, ashes, and stones, which accumulated around them to a depth of more than 6000 feet, so that they exceeded Vesuvius in the magnitude of their discharges. To these volcanoes we are indebted for the materials that form the long line of the Sidlaw and Ochil Hills, along the north side of the old lake, and the chain of the Pentlands,

PLATE VII.—Traprain Law, East Lothian—a volcanic "neck" marking the site of an eruptive vent in the early part of the Carboniferous Period.

with their prolongation into Lanarkshire and Ayrshire, on the south side. The rugged mountains of Glencoe and Glen Etive have been partly carved out of the lavas of another group of volcanoes in a separate western lake of the same period. Scattered volcanic vents likewise rose above the surface of the great northern lake, even as far as the remote Shetland Isles. Another centre of eruption is marked on the southern limit of Scotland by the group of the Cheviot Hills. Thus, partly by the accumulation of sediment in the lakes, and partly by the outpouring of volcanic materials, a considerable addition to the solid body of the country was made during the era of the Old Red Sandstone.

Eventually these sheets of fresh water were effaced, in some measure by being filled up with sediment washed into them, and with the lavas and tuffs piled upon their bottoms, but no doubt chiefly by the continuance of the plication of the terrestial crust. Their floors were forced up into the long north-easterly ridges out of which so many of the chains of hills in the central lowlands have been sculptured by denudation.

V. With the disappearance of the various basins of the Old Red Sandstone, the succeeding period of geological history, that of the Carboniferous system, was ushered in (Map V.). The chronicle of events over the south of Scotland now becomes remarkably full and interesting. The Highland region appears to have been at that time a wooded land whence the rivers carried down abundant white sand and grey mud into the shallow waters that stretched into the north of England. Lagoons and swamps, in which grew forests of a cryptogamic vegetation, spread southwards until they met the clearer and deeper sea, which then lay over most of Ireland and England, and in which an abundant calcareous fauna built up the thick sheets of Mountain Limestone. One of the most notable features of this period is to be found in the evidence that the whole region was undergoing a process of slow submergence, so that what lay at the surface at the beginning of the period had sunk several thousand feet below it by the end. In Scotland, the stages of this depression are well preserved. They indicate the rate of sinking to have been so tardy that the accumulation of sediment from the Highland uplands nearly kept pace with it, and thus that the water over that part of our area did not become markedly deeper, but rather retained its shallowness. The peculiar swampy vegetable growths, though submerged and buried under sand and mud in one district, sprang up afresh in another. These successive forests or jungles are now represented by coal-seams, and the sediment beneath which they were entombed has taken the form of sandstone and shale. That these shallow waters were immediately connected with the open sea, is shown by the frequent occurrence of marine shells among the layers of hardened mud. Intervals when the downward movement of the crust became for a while more rapid, or when, for some reason, the supply of sediment grew less ample, appear to be indicated by the thicker intercalated seams of limestone, crowded with the corals, crinoids, and mollusks of a deeper and clearer sea. This prolonged submergence extended over most, if not the whole of the British Isles, though its amount was not everywhere

the same. In the lowlands of Scotland it certainly exceeded 3000 feet, as can be measured by the thickness of the mass of strata deposited during its continuance. Obviously so serious a subsidence must have carried down much of the land below sea-level. There is reason to believe that in this way, before the downward movement ceased, part, if not the whole, of the Southern Uplands had disappeared beneath the water, and was overspread by at least the higher portions of the Carboniferous system. A similar fate may have befallen large tracts of the Highlands, although no evidence in proof can now be adduced. It is to the accumulations of this period that we stand indebted for our coal-fields, with their wealth of fuel, of ironstone, and of other useful minerals. These treasures, however, occupy now but a small part of the area over which they originally extended. Had it not been, indeed, for the effect of subsequent dislocations of the crust, whereby the coal-fields were let down many hundreds of feet, and were thus protected from denudation, these important elements in our national resources might have been largely or wholly removed, as has happened in Ireland, where no such fortunate series of dislocations occurred to retard or prevent the destruction.

The Carboniferous period in Scotland was marked by one characteristic feature which has given to the southern lowlands some of their most characteristic scenery, and has made the region one of classic interest to the student of geology. I allude to the remarkable development of volcanic activity by which the period was distinguished in this region. This activity was less vigorous than that of the Old Red Sandstone. It piled up no such heaps of lava as those of the Ochil and Pentland Hills. But it manifested itself over so wide a field, and its varying phases have been chronicled among the strata with such fullness of detail, as to afford most valuable information as to the history of volcanic energy. To the eruptions of this period we owe the terraced hills of Bute and north-west Ayrshire, which sweep into the Campsie range on the one side, and into those of Strathavon on the other; likewise the hills around Kelso and many picturesque heights in the lonely border country between the Rule Water and the Solway (unless some of these should be relegated to the very close of the Old Red Sandstone period). It was during the same long interval of volcanic energy that the rocks were erupted which have given us so many craggy eminences in Fife and the Lothians (Plate VII.) We can thus see that a protracted terrestrial subsidence, accompanied with a constant and copious deposition of sediment, and with abundant outpouring of volcanic materials, supplies highly favourable geographical conditions for building up the solid structure of a country.

VI. After the epoch in the history of the growth of Scotland which we have now reached, the records onward from the close of the Carboniferous period become few and fragmentary, finally ceasing altogether and leaving one of the longest and most momentous intervals in the gradual evolution of the globe represented only by a few scattered memorials. What changes took place in the topography of our region at the end of the formation of the coal-fields can only be dimly conjectured. The

PLATE VIII.—Sgurr nan Gillean, Skye—showing the characteristic scenery of the dark gabbro which has invaded the Tertiary basalt plateaux of the Inner Hebrides.

sunken tracts in which the Carboniferous system had been accumulated underwent those extensive dislocations to which I have already referred. The rocks were folded, and while some portions subsided still deeper below sea-level, other parts were upraised into land and suffered prolonged denudation. Among the faint records of these changes we catch a glimpse of shallow waters and salt lakes, scattered over the north of England and of Ireland and extending into the south-west of Scotland (Map VI.). In some of these lakes little volcanic cones made their appearance, but over a much-reduced area and on a greatly smaller scale than in any of the previous volcanic periods. From some of the scattered vents, feeble streams of lava and occasional showers of stones and cinders were discharged over the lake bottoms or upon the surrounding land. This episode has been best chronicled among the red Permian sandstones in the centre of Ayrshire, between Symington and Ochiltree, and in Nithsdale between New Cumnock and Thornhill. To the same period of waning volcanic vigour may perhaps be assigned some of the younger hills in the basin of the Firth of Forth from Arthur's Seat to St. Andrews. These various eruptions proved to be the last manifestations of volcanic energy in the early or Palaeozoic ages. When they died out a remarkable quiescence in this kind of subterranean activity settled down, not only on the British Isles, but over Europe generally. For a vast series of ages, embracing the whole of what is known as Mesozoic time, so far as we yet know, not a single volcanic eruption took place within our borders until the great outburst in the early part of the Tertiary period, to which I shall immediately refer.

Among the fragmentary memorials of what was happening in Scotland during the long course of the Mesozoic ages, some of the most interesting and legible are those which supply a glimpse of the geography of the country during the time when the great Jurassic series of formations was accumulating over the bottom of the sea that then stretched across England and the centre of the European continent. That sea extended up the west of Scotland along the base of the Highlands which were then probably land. We can still trace some of its shore-lines in Western Ross-shire and in Skye. From the great thickness of strata which overlies these lower littoral deposits, it can be seen that the Western Highlands and Inner Hebrides sank some hundreds of feet in the Jurassic sea. It is even possible that the subsidence may have so far affected the whole Highland region as ultimately to allow the same sea to spread across the entire breadth of the country, and to lay down some of the Jurassic sedimentary formations on the top of the submerged Highland tableland. But before the next great geological period, that of the Chalk, some parts at least of the Western Highlands had once more been raised above sea-level, and had been for so prolonged a period exposed to denudation that the whole of their Jurassic covering was worn away, so as to leave the platform of ancient crystalline rocks once more bare. Eventually the land, thus divested of its younger formations, subsided under the sea in which the Chalk was laid down (Map VII.). A small patch of the characteristic deposits of the floor of that sea may be seen under a protecting cap of basalt at a height of 1800 feet above sea-

level among the hills of Morven. This little outlier, which has been saved from destruction owing to the hard volcanic sheet that covers it, teaches some important facts in regard to a little-known interval in the history of the country. Thus it shows that when the ooze of the Chalk sea was in course of accumulation, the Western Highlands lay some 2000 feet lower than they do now, and were overspread by the sea, which may have stretched completely across the central parts of the country. It further proves that the region was afterwards uplifted to be once more a land-surface, which it has not improbably remained ever since. So vast a lapse of time separates us from that uplift that the sheet of Cretaceous deposits which once covered these northern uplands has been all worn away, save such little fragments as have escaped destruction from having been protected under durable sheets of lava. A further interesting proof that the Chalk once covered tracts of Scotland from which it has been entirely swept away, was afforded a few years ago by the remarkable discovery, made by the Geological Survey in the Island of Arran, that a large volcanic vent of Tertiary age has preserved masses of fossiliferous Liassic shale and large blocks of chalk. These must have fallen into the orifice from the strata through which the volcano had opened its way to the surface. It can thus be proved that the Lias and Chalk once extended from Antrim into the basin of the Clyde, though all trace of their former presence there has disappeared save in the blocks which, by so fortunate an accident, have been preserved in the heart of the Arran volcano.

I attach much importance to all such fragments of proof that stratified formations once covered regions from which they have been worn away, for this kind of evidence has a peculiar value in the inquiry into the origin and age of valleys. It is difficult to understand how some rivers should have chosen the channels in which they traverse the older rocks, in apparent defiance of all the structural features of the ground. But if they began their erosion on the comparatively smooth slopes of a newly upraised sedimentary formation, the courses which they took in it would be determined by the slight inequalities of that surface, and would be wholly unaffected by any complexity of character among the older rocks buried underneath. They would tend to retain these original courses, even when the process of erosion had cut down into the underlying rocks, and after the younger formation had been stripped off the face of the country. It is only by a supposition of this kind that it seems to me possible to account for many puzzling features in the valleys and river-courses of Scotland. It was during some later part of Mesozoic or an early part of Tertiary time that the present Scottish rivers began to flow, and to carve out the valleys, gorges, and glens which they are still widening and deepening.

VII. In our progress through the record of the past geographical vicissitudes of Scotland, we now again encounter one of the great blanks in the register of events. No memorials remain to tell what next transpired after the floor of the Cretaceous sea had been raised into land over so considerable an area of the country. Out of this blank, however, there rises the record of one great episode, which

PLATE IX.—Part of the Crest of Goatfell, Arran—granite breaking up under the influence of the weather.

has written its memorials widely over the British Isles, but more especially over Scotland. I have spoken of the proofs that, at a very early period in the geological history of the country, volcanic action broke out with great vigour, that it continued to manifest itself at widely separated intervals during an enormous succession of ages, that it has left many prominent and indelible tokens of its existence in the landscapes so familiar to us here, that after gradually declining in intensity and in the extent of the area of its manifestations, it finally died out among the lagoons and sandy plains of the Permian period, and that not only in this country, but over Europe generally, it appears to have remained dormant during the whole of the stupendous lapse of time which is called Mesozoic. But though dormant it was by no means extinct, for eventually it broke out again, on a more extensive scale than ever, and contributed, more than at any previous period of its eruptions, towards building up the solid framework of our land.

It was in an early part of what is called Tertiary time that this renewal of underground activity took place; perhaps at the epoch when the soft clay which underlies London was in course of deposition. The memorials of this rejuvenescence of volcanic energy have been so admirably preserved that the successive stages in its progress can be satisfactorily followed. It appears to have begun with a series of widespread and powerful earthquakes which convulsed north-western Europe, and culminated in the rending of the solid crust of the earth into thousands of fissures over the greater part of Scotland, the north of England, and the north of Ireland. These rents took a general north-westerly direction. Between their gaping walls, molten rock rose from some immense reservoir of lava, which underlay the region between the coast of Yorkshire and St. Kilda and was probably not less than 40,000 square miles in area. Whether over the south of Scotland and in England, the underground energy sufficed to open communications with the surface, and to pour out lava there, cannot be decided, for if any such outpouring took place, all trace of it has since been removed by denudation. So great indeed has been the erosion of the general surface of the country that rock enough has been removed from it to lay bare the fissures with their infilling of once molten material which, in the form of dykes or broad ribs of dark stone, can be followed over hill and dale for distances of sometimes more than a hundred miles. Among the Southern Uplands, for example, these dykes may be traced at the surface from the crests of ridges down into the bottoms of the valleys, whence it is clear that the valleys could not have existed as they now appear, for in that case the lava would have filled them up before rising to the tops of the ridges on either hand (Fig. 4). In this interesting and important piece of evidence, another proof is furnished of the comparative lateness of the period in which the present valleys were carved out.

In Antrim, through the chain of the Inner Hebrides, and still further north in the Faroe Isles and Iceland, the lava issued in copious streams at the surface, and covered many thousands of square miles of dry land, besides possibly advancing westwards into the sea (Map VIII.). These

streams accumulated one above another to a thickness in some places of more than 3000 feet, and in Scotland reached from beyond the south of Mull to an unknown distance on the farther side of the most northerly headlands of Skye. They formed a wide lava-desert, like those of Iceland at the present day, and this plain, black and rugged and dotted with little volcanic cones, skirted the bases of the West Highland hills, whence it stretched for many miles westward beyond the line of the Inner Hebrides. Across this tract the rivers carried the drainage of the interior and carved ravines and valleys out of the consolidated lavas.

Without entering into the long and varied history of this remarkable volcanic period—the latest in the geological record of our islands—we need only note here those of its phases which have chiefly contributed to the formation of the present landscapes of the country. The outflows of basalt have built up the thick and widespread masses of material out of which the terraced tablelands of Skye, Eigg, Mull, and

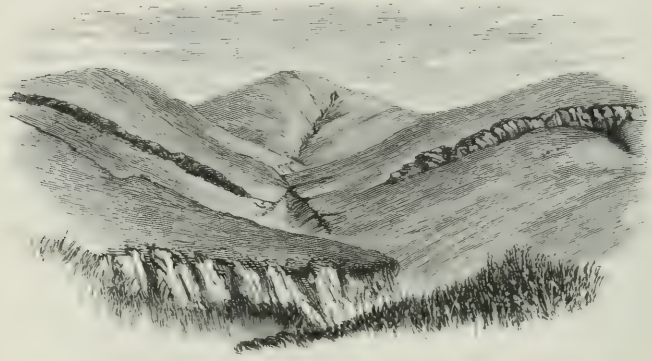

Fig. 4.—Tertiary Dyke, crossing a valley, Glengap Burn, near Moffat.

Morven have been sculptured. Later in date came the protrusions of black gabbro which have given us the serrated crests of the Cuillin Hills (Plate VIII.), the cones of Rum, the crags of Ardnamurchan, and the spires of Borrera at St. Kilda. Of still younger date were the granites and other acid rocks which rise into the smooth pale domes of the Red Hills of Skye, and Oreval in Rum, and the granite cones and ridges of Arran (Plate IX.).[1]

Although this volcanic episode was, in a geological sense, a comparatively recent event, yet, measured by years, it is now separated from us by so protracted an interval of time that the vastness of the amount of denudation undergone by the Tertiary volcanic rocks, together with the general surface of the rest of the country, cannot but fill us with astonishment. The lava-plain of the Inner Hebrides has been cut down into mere scattered patches, along the sides of which the level sheets

[1] This plate illustrates the characteristic manner in which the granite of a high crest splits up along its joints under the action of weathering. The Arran granite is most probably referable to a deep-seated part of the Tertiary volcanic series.

PLATE X.—Glaciated surface of Torridon Sandstone—Auchnashalloch, Ross-shire.

of basalt present their edges bare to the Atlantic storms. The surface of the plain has been deeply eroded, glens and valleys and sea-inlets, hundreds of feet deep and a mile or two broad, have been hollowed out of it, while from its surface so thick a mass of basalt has been removed that rocks like the gabbros and the granites, which doubtless at first lay deep underground, beneath the basalts into which they were intruded, now rise high above the remnants of the lava-tablelands into the clouds and mists of the tempestuous Hebridean climate. If, then, so stupendous an amount of erosion has taken place since Tertiary time upon these hard, durable, volcanic rocks, it may be confidently inferred that the denudation over the rest of the country has not been less marked. Thus both the basalt-plateaux and the dykes all over the kingdom combine to furnish a striking proof of the stupendous results achieved upon a land-surface by the subaerial agents of degradation, and likewise supply a demonstration that the present topography of Scotland has been sculptured out of rocks of many different ages within what must be regarded as a late period of geological history.

VIII. The last phase in the evolution of Scottish geography to which I will allude is that of the Ice Age, when the climate of this country became arctic in character and a thick sheet of land-ice enveloped the greater part of the British Isles. By the time that this great meteorological change supervened, the general surface of the United Kingdom had assumed the main features of its present configuration. The hills and valleys had taken the place and form which they still hold, though probably they presented a somewhat rougher or more rugged aspect than they do now. But by the end of the long period of refrigeration, many minor changes had been produced in the landscape. The long-continued movement of massive sheets of ice across the ground scraped away the loose material resulting from the previous prolonged subaerial decay, ground down, striated, and polished the rocks, and ended by giving them those peculiar smoothed undulating contours which are so unlike the effects of ordinary atmospheric waste, and which are recognised at once as signs of glaciation (Plate X.). Many basins were thus scooped out of the solid rock, and on the disappearance of the ice became the receptacles of little tarns or larger lakes. Vast quantities of clay, sand, gravel, and boulders, forming what is known as Glacial Drift, were spread over the lowlands and the valleys among the hills (Plate XI.). In the hollows among these irregular deposits water gathered on the retirement of the ice, and thus the whole of Scotland, highland and lowland, came to be thickly strewn with lakes and lochans. Since their birth, however, these abundant sheets of water have been continually disappearing. Wind by blowing dust into them, rain by washing down into them detritus from the surrounding ground, plants by growing over them, and man by draining them, have turned them first into marshes, and finally into land fit for tillage. Our Caledonian ancestors, who, according to the Greek historian, were wont to take refuge in bogs with only their heads emerging from the surface, had abundant and suitable places of retreat over wide districts where now they would find none at all. And yet if any one will take the trouble to traverse a district

of the lowlands in spring, when the land has been newly ploughed, he may observe that the soil in many of the hollows still retains the blackness derived from the decay of the marshy vegetation which marks the position of the vanished bogs and lakelets. But into the story of the influence of human labour in changing the face of the country I must not here enter.

In conclusion, let me remark that, although the history of the example of geographical evolution which I have here rapidly sketched may perhaps seem rather complicated and confused, the main broad lesson which it has to enforce upon our attention may, I hope, be easily recognised and appreciated. We learn from it, by an appeal to the facts of Nature, through what a long succession of terrestrial changes the site of a country may have passed, and by what kinds of evidence this succession can be clearly established. It shows that the present geographical condition of Scotland, so far from being aboriginal, is only the latest of a long series, wherein each phase has been intimately linked with those that went before and those that came after. By the revelation thus unfolded, it impresses upon us how vague and incomplete our conceptions of landscape must be, unless we acquire some knowledge of the origin and relations of the different topographical features which give to landscape its distinctive characters, its variety, and its charm. And thus, by imparting an added and vivid interest to the familiar scenery around us, it heightens our appreciation of the claims which our own native land has upon the affectionate devotion of her sons.

THE FÆRÖE ISLANDS.

By James Currie, M.A., F.R.S.E.

(*With Illustrations.*)

(*Continued from page* 76.)

We may turn now to the human inhabitants of the Færöes, and note that there has been a considerable increase in the population of recent years. Landt estimated it at 5000 in 1800; by the middle of last century it had increased to about 8000; and after another fifty years to 14,000; while it is now about 15,000. The pressure of this increasing population may be a difficulty in the future; but so far the means of livelihood have increased in even greater proportion, so that the 15,000 live in more comfort, and are altogether better off, than the 5000 of a hundred years ago.

By descent the Færöese are mainly Scandinavian. When the Viking raids of the end of the eighth and beginning of the ninth centuries began to give place to emigration with the definite purpose of settlement, some families found their way to the Færöes, and these doubtless received a large accession when the victories of Harald Haarfagre, and especially the battle of Hafrsfjord in 872, laid the south-west of Norway at the

PLATE XI.—Section of Glacial Drift, Brownhead, South Arran.

feet of the Eastern king. Among at least the earlier settlers, who would probably first occupy the nearer southerly islands, which are also the most fertile, there were many from the Hebrides and Ireland, and no doubt there is a considerable infusion of Celtic and Celto-Iberian blood in the veins of the Færöese. One of the churches in Sandö was dedicated to St. Brandan.[1] The islanders, although predominatingly blonde, are as a rule by no means of the marked Scandinavian type that is to be seen, for instance, in some parts of Sweden. But so many of the original settlers must have come from the fjords of South-Western Norway—the very district where to this day the inhabitants are least typically Scandinavian—that it is impossible to determine to what extent the dark strain in the Færöese population is due to original Norse elements, and to what extent it is due to the admixture of Hebridean and Irish blood. Perhaps, after all, the inquiry might mean but little ethnically, since it is possible that the dark Norwegian and dark Hebridean element may have the same prehistoric source.

One thing can be said with certainty, and that is, that small as the archipelago is, there is a considerable difference between the people of the various islands, and especially between those of Syderö and those of the remainder of the group. The former, according to all observers, are markedly shorter, darker, more brachycephalic, more lively, more cheerful, and (although the assent of Syderö on this last point would probably not be a hearty one) less reliable.

As in the case of Iceland, the first discovery seems to have been made by Irish anchorites. In his work *De Mensura Orbis Terræ* the Irish monk Dicuil or Decuilus writes in 825 of a group of islands beyond the British coasts, "consisting of small islands separated by narrow sounds, on which for about a hundred years there dwelt hermits who had come from our fatherland Scotland [*i.e.* Ireland]; but even as these islands from the creation of the world until then lay waste, so are they now, on account of the Norse pirates, deserted by these anchorites; but they swarm with innumerable sheep and an extraordinary number of seafowl."

There is a persistent tradition in Syderö that when the first Scandinavians came to that island they found it already occupied by holy men, who ate no meat, but only eggs and seaweed and milk, and who worked miracles. They are often said to have been exterminated by the Norsemen, but there does not seem to be any ground whatever for this statement. They had come to these remote islands in search of solitude, and this they could no longer enjoy after the arrival of Norwegian settlers, even although some of these were in all likelihood Christians. Probably, therefore, all that happened was that the anchorite community ceased to be recruited from the South. In any case, however, we can hardly suppose that these hermits are responsible for any of the characteristics of the present inhabitants.

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[1] A. Bugge, *Vesterlandenes Indflydelse paa Nordboernes og særlig Nordmændenes ydre Kultur, Levesæt og Samfundsforhold i Vikingetiden*, p. 357. In this work the whole question of the relations between the Færöes and Iceland on the one hand, and the Hebrides and Ireland on the other, is very exhaustively and interestingly worked out.

The nomenclature of the islands is nearly pure Norse, and many of the names have a very familiar sound to those who have any acquaintance with Orkney and Shetland. The voes and firths and wicks of our islands reappear, hardly disguised under the forms of Vág and Fjörð and Vík. Lerwick is paralleled by Leirvík in Osterö; Stromness by Streymnes or Strömnæs in Strömö. The hammers of Færöese topography remind us of Hamrifell in Yell, and of the Dwarfie Hamars in Hoy. Koll, a rounded hill, appears in Færöe as Kollen, there pronounced Kodlen, while in Shetland we have Collafirth, and in Foula Kodlifell, with the same change in pronunciation. And other examples could be adduced by the hundred to remind us that a thousand years ago people speaking one tongue inhabited all these islands. Occasionally one comes across a word that is also kept in English while it has dropped out of the continental Teutonic languages, e.g., *kujla* (to) kill.

Limited as the extent of the group is, there is still room for dialectal differences in the language, especially between Syderö and the more northerly islands, which may be simply the result of partial isolation, but which, on the other hand, may be hereditary, and correspond to the somewhat different origin of the inhabitants. An indication that the latter hypothesis may be the more correct is to be found in the fact that in the seventeenth century there was, according to Debes, "a great difference between the speech of the people who live in the northern part of the land and those who live in the southern islands." The dialects would seem therefore rather to have approximated than to have diverged.

The Færöese, both men and women, are a handsome, muscular, long-lived race. To some extent this is the result of the active life on sea and mountain. In part also it is no doubt due to Natural Selection, operating through a prolonged period; for under the conditions of life in these islands the weak had little chance of surviving. The men are well formed, but not generally tall; and according to the popular belief, which may be well founded although a similar opinion has been held by all people in all ages, there has been a deterioration in this respect within the last few generations. Marks on the rocks are still sometimes shown as indicating the height of such and such a man of the olden days. Sometimes these are up to and over 7 feet, whereas a height of 6 feet is now extremely rare, and the average is considerably below this.

Similarly the men of to-day are reproached with not being able to lift the weights that their fathers could raise; but in any case they can still bear burdens that in most other countries would be regarded as marvellous. Thus Pastor J. F. Rönne, who some five years ago published an interesting little book on Færöe and the Færöese, vouches for the truth of the story that a man of Skuö carried a cask of syrup from the landing-place on that island up the steep rock-hewn steps that lead to the village a hundred feet above, and that when it was weighed it was found to be 462 Danish lbs., or say 4½ cwt. Two hundredweight is said not to be an extraordinary burden for a man to carry for several miles over the mountains. I have on various occasions myself wondered at the heavy loads of peat that the men carry down from the hills. The *leypur*, a wooden basket in which such loads are carried, is borne on the back,

supported by a woollen band that goes over the forehead, in the same manner as a Newhaven fishwife carries her creel.

The Færöeman is at his best on the sea and on the cliff. The same quickness of eye and hand that serves him in the management of his boat in that stormy sea is conspicuous when he scales the precipitous rocks whence he draws no inconsiderable proportion of his sustenance. In both occupations he exhibits unsurpassed skill, and yet each claims its victims every year. While I was in Færöe last summer two fowlers, father and son, fell over the cliffs of Hestö and were killed. Taking a period of about fifty years, ten per cent. of the deaths among the men are found to be due to accident. Drowning of course accounts for the most of these; but considering the much smaller number employed in fowling the latter occupation gives a much higher proportion of accidents.

Those who have visited the islands are unanimous in their appreciation of the character of the inhabitants. Honest, courteous, hospitable, frugal, sober, and clean: such they were described by Debes more than two centuries ago, and such they remain to this day.

On the other side of the account there is really wonderfully little to put down. The most prominent of the defects of the Færöese character is a certain dogged obstinacy, which inclines them to an extreme and unreasoning conservatism, so that they cling to customs obviously prejudicial. While this accusation cannot be denied, it is true at the same time that habits have been adduced as evidence of this which are either harmless or, under the conditions imposed by situation and climate, even beneficial. And, after all, an unreasoning adoption of the new is not much more to be commended than an unreasoning adherence to the old.

There is one characteristic of the manners of the Færöese interesting to us in Britain, whether this should be counted among their virtues or their failings: they keep the Sunday strictly 'paa engelsk Maade'—in the English manner—doing only such work as is absolutely necessary.

With regard to the dress of the inhabitants there is little to remark about the costume of the women, since there, as in many other places, these have been the first to abandon their picturesque national attire, and unfortunately they all seem to prefer very sombre colours. On the other hand, however, the usual head-dress is still a kerchief and not a hat or bonnet. The dress of the men is more characteristic, consisting of a soft cap of striped linsey; a brown jacket, woollen waistcoat, black breeches (which it seems the fashion to leave unbuttoned at the knees), thick knitted stockings, and yellow shoes of tanned sheep or ox-hide. The shoes have no soles, and are sewn only at the heel, and from the toe to the instep. They are laced cross-wise round the ankles with plated strings of white wool. The women wear similar shoes, generally of sheepskin, and their laces are red or blue.

Now let us turn for a few minutes to the habitations of the people and their means of life.

When the voyager regards the Færöes from a distance the first impression he receives is one of barrenness and desolation, an idea that arises from the fact that it is the steep precipices that necessarily first

front the eye, while the ledges and flats, where there is often a rich growth of natural grass, are either invisible or foreshortened. When he approaches close enough to the shores to distinguish some of the details of the landscape, he cannot fail to remark the patches of brighter green that at the head of every fjord and at the mouth of nearly every valley stand out in vivid contrast to their surroundings. These greener patches are the fields that encompass the villages, and when the traveller comes nearer still he will soon distinguish the tarred timbers and, with more difficulty, the green turf roofs of the houses, nestling probably under the protection of the little church, itself as a rule timber-built and turf-roofed. The capital, Thorshavn, in Strömö, is by far the largest town, and has over a thousand inhabitants. The next most important places are Vestmanhavn, in the same island, and Tveraa, in Syderö. As a rule, however, the population is distributed in small hamlets.

Such a village gives to the stranger the idea of a much larger population than it actually contains, for every habitation consists in fact of a group of buildings, each devoted to a special purpose. Thus there is in the first place the so-called Rögstue (Roykstova), which is kitchen and parlour, and sometimes bedroom also. To this room there is added in all the better houses one or two apartments adapted for the reception of guests, and where the household also sometimes sit. Very probably there adjoins these at one end a byre for the cows, with perhaps a little room for the quern between; and there will also very likely be some small rooms, or rather closets, for beds, or for keeping articles of household use, which are obtained by continuing the roof out beyond the walls of the house proper, or rather by putting back these walls, without moving the posts upon which the roof rests. Apart from the main building there will be one or two erections with vertically sparred sides for wind-drying fish and meat, a shed for storing turf, and another for hay, and a house, the Sodnhús,[1] for drying corn preparatory to threshing it. Further, there is generally a boat-house, which of course is placed as near the sea as can safely be done. On account of the heavy surf this is often not very near, and then the boats have to be hauled up the rocks, frequently to a considerable height.

Let us now return to the house proper. At first, long ago, most of the Færöe houses were built of stone, because juniper and willow-twigs—the only wood produced in the islands—were not adapted for architecture; and, on the other hand, it was not always convenient to wait until the waves threw up suitable drift timber. But wood was in so many ways so much more convenient and comfortable that occasional houses, especially among the wealthier Bönder, have no doubt always been built of wood, sometimes in the old Norse style with horizontal beams, but more generally with upright timbers. And with the resumption of more frequent intercourse with the Continent timber houses took the

[1] This word has rather an interesting history, being derived from the Gaelic *Sorn*, which again is from the Latin *Furnus*, an oven. See A. Bugge, *Vesterlandenes Indflydelse* (*Skr. udg. af Vid. Selsk. i Chr.*, 1904), p. 257. The Shetland *Sinnie* seems to have the same origin.

place of stone ones, and for several hundred years have been practically universal in the islands.

Formerly there were no windows in the rooms at all, and what light did manage to get in came either through the doorway or from the Ljor, the square opening in the roof which served at the same time to

FIG. 4.—Thorshavn.

carry off the smoke from the open hearth. This opening could be closed when desired, and in order that all light should not thus be obscured the shutter was formerly made of skin in a wooden frame. Now that windows are universal the shutter is usually a wooden one. It is worked by a long rod of wood, which is set against a cross-beam when it is desired to open the Ljor, and hangs free when this is closed. In at least one house in Thorshavn such an arrangement may still be seen,

but nowadays stoves are beginning to be used, and the Ljor has in such cases become superfluous as far as the smoke is concerned, although it might sometimes be retained with advantage for ventilation.

Formerly the floors of the house were of mud or clay, upon which, for festive occasions, sand was spread, and in the middle were the flat stones that formed the hearth. Now the floors are nearly always of boards, and the fireplace is built in against one of the walls. Over the fire there hangs a pot, which can be moved up and down upon a vertical iron bar with nicks in it, which is fastened to a cross-tree. The place of the old stone seats, which, with a layer of hay and a blanket, served also for beds, has been taken first by wooden benches, and later by chairs.

At night light is now obtained from paraffin lamps. Once upon a time the only means of illumination, besides the fitful glow of the open fire, was one of the small iron train-oil lamps of the same shape as those used till lately in Shetland. This change is one that is bound to have very far-reaching consequences.

The roofs of the dwelling-houses are covered with green sods placed either upon straw or, as is now general, upon birch bark. This covering adds very much to their picturesquesness, for the roofs yield a luxuriant crop of grass, which is often rich enough to make it worth while to mow it. As there are no goats in the islands—or at least only a score or two—one does not, as sometimes in Norway, see these animals browsing upon the roofs, and the only creatures I observed in that situation in Færöe were hens and children. Some of the public buildings, such as schools, are roofed with slates, or, which is even more distressing, with corrugated iron.

Immediately outside the village is the bright green patch of ground already referred to, which consists of the cultivated land, the so-called Bö or Infield, while beyond this there stretches the waste or uncultivated land, the Hauge or Outfield, extending far out of sight over the mountains. The cultivated land amounts to only 2·6 per cent. of the total area.

The trend of development in the Færöes has been pretty steadily from a communal to an individualistic basis. Thus the cultivated land round the villages was formerly common property, but is now divided. A survival of the older system is seen in the regulation by which this is still available for the common grazing of the sheep during the winter.

The land of Færöe, of which the total taxable value is 4,258,740 kr. (say £234,000), viz. 1,709,330 Infield, and 2,549,410 Outfield, is held, apart from the parsonage lands, by one of two tenures. Either it is held from the Crown at a very moderate rental by tenants, Kongsbönder, whose farms pass undivided from father to son, or it is held allodially by freeholders, Odelsbönder, corresponding to the Udallers of Orkney and Shetland, who may divide their property among their heirs. About half of the total land is held on each tenure, but owing to the power of division among heirs the freeholders are much more numerous and much poorer than the King's tenants. At one time division of the land by inheritance and by sale was carried to such an extent that one case is

recorded where the property of a man was split up into 91 separate pieces, the smallest being only 24 square ells, or say 12 square yards. Now the land may not be inherited in smaller portions than a minimum fixed by law.

Each share in the cultivated land carries with it the right to participate in the profits of the sheep or to pasture a certain number of them, and it further carries with it the right to pasture on the Outfield as many cows as the owner can feed in winter with the hay from his Infield possession; and it also gives him a right to various privileges, such as a share in the proceeds of the bird cliffs, in the seaweed gathered from the shore or the whales driven upon it, and so on.

Naturally the land taken up by the first settlers was largely that which seemed likely best to reward cultivation, but it should not be supposed that the green fields are altogether a gift from Nature. On the contrary, they have often been won from her as the result of a patient and unremitting struggle. The boulders which cumbered the slopes have been carried away for the most part upon men's backs, while not infrequently a large part of the soil has been carried in the same way from the bottom of the valleys and spread over the ground thus won from the waste.

If we were to arrange the sources of subsistence in Færöe in the order of their profitableness, we should take first fishing, next sheep-breeding, third agriculture and cattle-raising, and lastly fowling. But it will perhaps be more convenient if we take them in the order of their distance from the village.

Proceeding from this, then, we find ourselves at once in the midst of the agriculture, such as it is. The first thing that strikes a stranger is the way that the fields are laid out. They are generally long and narrow, perhaps only about 12 feet wide, and are separated from one another by ditches, the one side of which is higher than the other, the field thus sloping from the high side of one ditch to the low side of the next. The ditches are often full of marsh marigolds, so that in early summer the fields are separated by lines of gold.

The crops grown in Færöe consist exclusively, or almost exclusively, of barley, hay, potatoes, and turnips. Occasionally there is a small patch of oats, and one may include in this list the angelica, which is sometimes seen in small enclosures near the villages, and of which the Færöese are extraordinarily fond.

By far the most important crop is the hay, which occupies about nine-tenths of the cultivated area: and indeed the corn itself is often planted less for its own sake than to prepare the ground for the next six or eight years' hay-crop. Altogether nearly 8000 acres are devoted to this, yielding about 4700 tons of hay. This is mostly used for the winter feeding of the cows, about 25 cwt. being reckoned winter fodder for one cow. The grass is nearly all natural, although of late years a little has been sown, and, as will be seen, the yield is light. In August, when the grass is ripe, or perhaps over-ripe, it is mown with a short-bladed scythe, spread on the fields to dry, gathered by hand into small haycocks, and ultimately put into stacks. After the harvest is ended the

men bring the hay home on their backs in large bundles of about $1\frac{1}{4}$ cwt., and it is then stored either in stacks in stackyards, or else, according to a more recent practice, in huts built for the purpose. The bringing home of the hay is the occasion for one of the annual festivities.

Almost the only grain crop is barley, or rather bere, of which about 1600 bushels are raised upon 800 acres. This leaves about three times as much to be imported.

In the preparation of the ground for corn a strip along the high side

Fig. 5.—Tveraa.

of the ditch is cut down and the soil spread over the field on the top of the manure, which is often seaweed; while the green sods from the strip are carefully placed at the bottom of the excavation, so that the whole field is moved along a couple of feet, gaining at the low end what it loses at the high. In many places, however, the soil is too shallow for this treatment, and sometimes the rock is only covered with two or three inches of turf. In this case the turf is carefully peeled off, the manure is spread on the naked rock, and the turf is turned over and replaced. It is then chopped up with spades, and the corn is sown in the soil so prepared, and is thereafter beaten in with a wooden board fastened to the end of a stick.

When it is considered ripe enough, some time towards Michaelmas, the corn is cut, not as a rule with scythes or sickles, but with knives. The sheaves are laid with the ears hanging over the ditch, if there is one, and after a very few days of this drying are carried home and the ears taken off. The grain is then dried either in a special house or over the fire, threshed by means of a wooden club about 18 inches long, and finally winnowed.

The corn is now ready to be ground. This is generally done in a hand quern, which is to be seen in nearly every house, and which, as already mentioned, has sometimes a small room specially for its use. As the stones are usually smooth, grinding corn is very tedious work, and therefore no more is done at one time than is required for the day. Not more than a bushel of grain can be ground in a whole day. Sometimes this labour is avoided by the use of small water mills. These are of the ordinary type seen in Norway and in Shetland. In Færöe they are small wooden buildings, and the machinery is of a very simple construction. The corn feeds itself from a hopper into the eye of the upper millstone, which is fastened to a vertical spindle worked directly by a horizontal 8-bladed wheel.

All the work in connection with the drying, threshing, winnowing and grinding of the corn is done by women.

I have already mentioned that after the harvest the cows are permitted to come into the Infield, and in a few villages the best cows are kept tethered close to the village. Otherwise they wander in summer on the hillsides picking up a somewhat precarious livelihood upon which there is little chance of growing very fat. In winter they are kept constantly in byres. The number of cattle varies from year to year. In 1898 it was 4516, which was not enough to supply sufficient milk and butter to the whole population, the yield of milk being small—in Landt's time not more than a gallon a day from each cow; and the conditions are probably still much the same. When the cows are out on the hills the milkmaids have often to go a long way to find them. The milk is carried home in narrow wooden pails, the top being covered with tanned lambskin to prevent spilling. The pail is carried on the back by a woollen band passing over the breast, but often a girl is amiable enough to milk for some of her neighbours, and then she may have two or three pails on her back and one on each arm, which does not prevent her knitting as she goes.

Much more important than the cattle are the sheep. An old Færöese proverb declares that: "Seyða ull er Föroya gull"—Sheep's wool is the gold of Færöe. We have already seen that there were sheep on the islands when the Norsemen first arrived there, and sheep-breeding is still one of the most important industries. The approximate number of sheep is 100,000, or about 6 per head of the population, as compared with 0·8 per head in this country. They are mostly owned in common; that is, each member of the community that possesses them takes a share in the produce in proportion to his interest. Of recent years there has been a partial reversion to an older system, and individual ownership has become commoner than formerly. But whether the sheep of any

particular village are owned separately or in common they are looked after by a shepherd, the so-called Söjdemand, who is appointed at a yearly meeting of the owners. This man has sometimes as many as 500 sheep under his care, and he is expected to know them all, and to attend to them the whole year. The wool is not clipped, but is plucked by hand when it loosens in summer. (Fær. *royta* = Shetl. *roo*.)

The Færöe sheep belong to two very distinct races, and here again the division is between the Southern and the Northern islands. The sheep of the latter are much larger and yield fifty per cent. more wool. They are said to have come from Norway or Iceland, whereas the sheep of the Southern islands are believed to be a cross between Highland sheep and those originally found on the islands.

The next most important source of subsistence derived from the land is fowling, and in nothing is the skill and courage of the Færöese more strikingly displayed than in the bird-catching upon which they depend in many villages for a considerable part of their food. The bird cliffs are generally those that face the west and south, and to a stranger it might well seem that the sea-birds that nest there need fear no enemy not provided with wings. But the skill and hardihood of their human foes are too strong for them, and every year about a quarter of a million fall victims to the fowler. The birds generally taken are Puffins, Guillemots, and Kittiwakes. There are two principal methods of catching the birds. The first, which only applies to Puffins or Shearwaters, is simply to drag them out of their holes among the loose stones either with the hand, or when, as is usually the case, the hole is too deep for this, by means of a hook attached to the end of a stick. This is not, however, fine art. The real fowler catches the birds by means of a net fixed between two prongs at the end of a 12-foot pole, the *fleiasteng*. The birds are caught on the wing and with a dexterous turn of the wrist are entangled in the meshes. A few are caught in this way from boats at the foot of the cliffs, but to obtain most of them the fowler has to climb the steep rocks or be lowered at the end of a long line and wield his pole from an insecure seat on one of the narrow ledges, it may be hundreds of feet above the sea. Sometimes an expert fowler will catch in this way as many as six or eight hundred in one day. Besides the flesh, these birds yield of course a great quantity of feathers. About twelve Guillemots or thirty Puffins give a pound weight of feathers.

Besides those mentioned above, the Færöese have another source of wealth, and this is practically inexhaustible. It is the sea fisheries. It is true that they complain that the fish have deserted the banks, and that the yield is not what it was "in the good old days." But, except as regards the cause assigned for the decrease, each age has made the same complaint. At the end of the seventeenth century Debes attributed the diminution to "the sins of the people of Færöe," while the fisherman of to-day more prosaically blames the trawlers.

As a matter of fact there is no real evidence of any decrease at all, and the value to the islands of their fisheries is immense. The export alone exceeds a million crowns per annum; and when it is considered that this means about seventy kroner, or say £4, per head, and that in

addition there is the large quantity of fish consumed in the Færöes, it will easily be seen how important the industry is.

A good many Faröese have of late years gone annually to the Iceland fishing, and money is brought into the islands in this way. This is another of the causes of the profound change which appears to be beginning in their social economy. Not only does it bring the people into intimate contact with others, and supply them with new needs and at the same time with the means of gratifying them, but it also affects the life at home because it takes away a large number of the young men and women at the time of year when they are wanted for agricultural operations.

In considering the value of the fisheries the "Grindehvaler" must not be left out of account. For although the number captured annually fluctuates very much, yet on the average a thousand are killed every year, and these are worth about 60,000 kroner.

Nor in an enumeration of the sources of Færöese wealth can we afford to overlook the turf or peat which is found nearly everywhere, and which is the usual fuel of the islands, except in a few parts of Syderö, where the native coal can be conveniently used. It is cut with a long spade not more than four inches broad in the blade. The process of cutting and drying does not seem to differ much from that to be seen in operation in the Highlands of Scotland, except that more care appears to be taken not to damage the ground, and the sward from the surface is carefully replaced after the peat is removed. When the peats have been dried in small heaps, they are either put into large stacks or, more usually, stored in a Krógv, which consists of a low stone wall, circular at one end and open at the other. In this the peats are heaped up to a height of four or five feet and then covered with sods. These little enclosures, which are often seen high up on the moors, are sometimes so numerous as to form quite a feature of the landscape: thus there are over three hundred of them within a kilometre of the Infield of Thorshavn.

As regards government, the islands constitute a province of the kingdom of Denmark, with a Governor (Amtmand) to administer their affairs. They return a member to each House of the Parliament in Copenhagen, but have a large measure of local government. The legislative body for Færöe is the Lagthing, elected by all the men over twenty-five years of age. All merely local affairs pertaining to the separate villages, and in which the common interests of their respective inhabitants are concerned, are determined by village councils. To them are committed such questions as regulations concerning the grazing of cattle, the keeping of geese, the use of the roads, fowling in particular cliffs, and so on. The same bodies may also make enactments regarding affairs of their respective villages that do not exactly concern common possessions or rights; but in such cases the by-laws require provincial sanction.

The mention of roads suggests the remark that although it would not be strictly true to adapt the famous chapter in Horrebow's *Natural History of Iceland* and say, "There are no roads in Færöe," yet, except

in a few places near the larger villages, the roads are merely directions indicated by small cairns at distances from one another determined by the character of the ground. Outside the common (Hauge) belonging to his own village no person has any right to go except by the marked road, and even within the bounds of his own common he may be limited by the by-laws of his village. I acknowledge with gratitude that these regulations were never enforced in my case. When I came across one of the solitary shepherds on the hills I always found him quite pleased to enter into conversation and ask the latest news of the war in the Far East, and always sufficiently hospitable to refrain from hinting that I was a trespasser and liable to be suspected of having designs upon the sheep.

The population belongs almost exclusively to the Lutheran Church, although there is a dissenting chapel in Thorshavn which has a few adherents. The islands are divided into seven parishes, but each parish has from five to seven churches. Consequently the clergyman holds service in each only occasionally, and some of the more exposed and inaccessible are only visited two or three times in the year. One of the most difficult to approach is Store Dimon, and the road up is a very narrow one along the cliff face. At one time the pastor was liable to giddiness and could not visit it at all, and the story goes that when at last his successor was appointed and made a pastoral visitation, he found that the marriages and christenings of several years had accumulated, and that the former were required to regularise the latter.

When a clergyman does succeed in reaching one of these places everything has to be hurried up. As a writer on Færöe, himself a clergyman, says, "The bridegroom must be fetched from the cliff and the bride from the cows up on the hills; the parents busy themselves to get godparents for their unbaptized child; and the relatives have to be gathered to go to the grave upon which earth is now to be cast." There are many places where only an occasional landing is possible, and where without warning a sea may suddenly arise that will make departure impracticable. It is related that one clergyman, having visited Fuglö and, in spite of the boatman's warning, stayed to take a hasty meal pressed on him by his hostess, found when he came down to the shore that he was too late, and had to remain for four or five weeks upon the too hospitable island.

The foregoing is a short and very imperfect account of the Færöes. It is not indeed altogether easy to give a true idea of their darker features, of storm and fog, of desolate plateau, rifted peak, and frowning precipice. Still more difficult is it to convey any clear appreciation of the subtle charm that makes one bright day compensate for many gloomy ones. Of one thing I am perfectly sure, that there is no one who has spent any time among the islands, whose heart does not turn to them with affection, and who does not cherish the memory of some incomparable hour. Perhaps he recalls some summer evening, when the salt sea-wind for once was mild, when he lay stretched upon the turf, with the frowning hammer above and the ocean far below, upon whose surface the distant islands, luminous and half-transparent in the

level sunlight, seemed to float enchanted. A scene like this I remember well. All around was the silence of the hills, not broken but rather emphasised by the soft complaining of the eider ducks on the fjord beneath, the thrilling, throbbing cry of the whimbrel, and the sorrowful pipe of the golden plover along the slopes. On such an evening there is born into one's heart a real affection for this lonely little land, lost in the grey seas. It is with regret that one at length sails away, and sees melt upon the horizon far astern the misty shapes that might be clouds, but are the last vanishing glimpse of the mountains of Færöe.

To those who are at all familiar with books upon Færöe my indebtedness in the preparation of the above paper to Landt, Geikie, Rönne, and Bruun, will be abundantly evident. My acknowledgment here to these authors is therefore less an act of justice than an expression of gratitude. For the photographs accompanying the paper I have to thank my sister, Miss Elsie M. Currie.

NEWFOUNDLAND.

By A. L. Cross, F.R.C.I.

(*With Map and Illustrations.*)

It seems a surprising thing that one of Britain's oldest colonies should be within seven days' sail of it, and yet be comparatively unknown. Few visitors, either sportsmen or tourists, have gone there, though it lies directly at the door of our greatest colony, viz. Canada. No doubt the trouble with France over the "foreshore" question has kept back immigration, but this is all changed now, and I hope an era of prosperity may open for an island which possesses some of the loveliest scenery in the world, and is a perfect paradise for the fisher and deer-stalker.

I was originally attracted to the island by a book written many years ago by the late Rev. M. Harvey of St. John's; but as Mr. Harvey's book was not a tourist's guide, and I could obtain no recent information, in the spring of last year (1905) I determined to go and find out something about it on the spot for myself.

The famous John Cabot, sailing from Bristol in 1497, discovered Newfoundland. According to Judge Prowse of St. John's, who seems recently to have studied the history more than any one, "there are no English records of this famous adventure, beyond an entry in the Privy Purse expenses, 'to hym who found the New Isle, 10 Pounds'; and the second, 'Charter to John Cabot,' in which he is named the discoverer. All our information is derived from Italian and Spanish letters written immediately after his arrival in August 1497." From that day downwards the island has been more or less in the hands of the English, though sadly mismanaged and neglected until very recent times.

The whole island lies south of 51° North latitude, and extends to 47°. Great Britain lies wholly to the north of the 50th parallel, so

Newfoundland is really in the latitude of France. It is larger than Ireland, with a scanty population of barely 225,000 scattered in villages along the coast and in St. John's. People run to Norway and to Switzerland, and spend quite as much money in these countries as would give them an outing in the fine air of Newfoundland, and amongst a very friendly, honest, and entirely English-speaking people. The accommodation is somewhat primitive for the most part; but there is little difficulty in

finding quarters, as most of the small farmers and villagers on the coast are willing enough to entertain respectable strangers. The charges run from $2 in St. John's, to $1 and $1·25 per day in coast or country places. I always found the accommodation thoroughly clean, which is more than can be said sometimes for more pretentious places in Norway. There are many parts of the country, however, where it is impossible to go without camp equipment, though it need not be very elaborate, and guides can generally be had, if arranged for beforehand, to look after the camp, cooking, etc. Provisions are not expensive, and no one wants luxuries, where fine air, rare and abundant fishing and hunting are to be

had. If a tourist merely desires to see the beautiful scenery of the country, the best plan is to take the coasting steamers, or follow the railway route with a "stop-off" ticket from St. John's, stopping at various places marked on the railway guide, which this year (1905) has given a great deal of information, mostly, however, unknown to the officials on the line, who should have the dissemination of it. It is principally as yet on the coast that the people live. Inland, the country generally is a vast wilderness—much of it still unexplored—of forest, barrens (moors), and endless lakes (generally called ponds, as it is said the original Devonshire settlers were ignorant of lakes), big and little, some of them of great size, such as Grand Lake, fifty-six miles in length, Red

Fig. 1.—Off St. John's in May.

Indian Lake, thirty-four miles, Deer Lake, twenty-five, Twenty Mile Pond, and others, all over the island, too numerous to mention. One-third of the area of the island is said to be covered by water, and I can well believe it, after seeing the numerous lakes.

The quickest way of reaching Newfoundland is by the Allan Line from Glasgow or Liverpool—a matter of not more than seven days to St. John's, the capital. In a Cunarder it could doubtless be done in four, as it is only some 1640 miles from the Irish coast. The railway runs from St. John's on the south-east coast of the island, to Port Aux Basques, the terminus, in the extreme south-west. It is about 530 miles in length, and has been so arranged as to serve as nearly as possible the principal villages on the east coast as far as 49° North latitude; and then near Lewisport, an important lumber port, to which there is

a branch line, it turns west across the island to the large village of "Bay of Islands," facing the Gulf of St. Lawrence. The line then turns south-west, and runs through the hills till it reaches Bay St. George on the coast, thence along the coast to Port Aux Basques, facing Cape Breton Island, on the opposite side of the gulf, from which it is separated by eighty or ninety miles of sea. I visited the island, the reverse way, coming by railway north from New York, through Maine, New Brunswick, Nova Scotia, and Cape Breton Island, and crossing from North Sydney in the latter by the mail steamer of the Reid Newfoundland Railway Company, the ss. *Bruce*, to Port Aux Basques. The voyage is always made at night, and occupies about six hours, comfortable cabins being provided in the steamer for passengers.

As we approached Port Aux Basques on a fine June morning, we had a splendid view of the Long Range Mountains, partly still covered with snow, mostly lying in the deep narrow ravines, where it had fallen to an enormous depth. We were informed that the snowfall of the previous February had been especially heavy; in some places snow fell to a depth of ten feet, blocking up the railway line. It is only about five years since the railway was finished right to Port Aux Basques, and now it is becoming a favourite summer route from the States and Canada. The mail-trains are well supplied with sleeping accommodation, dining-car, etc., and are built to give passage right through, as in Canada and the States.

As there never was a trunk road across the island, the railway answers all purposes. A new line connecting with the south-east coast, and running along the south of the island at its broadest part, would greatly shorten the route to Port Aux Basques, and open up the country there; but the poverty of the Newfoundland Government will, I am afraid, prevent this being carried out for many years to come, unless they agree to join Canada, and of that there is no sign or desire.

Port Aux Basques lies at the side of a small inlet of the sea, and is visible a long way off in fine weather. It is yet a place in embryo, and consists of a lighthouse, a few wooden houses, a railway station, and goods sheds. It may yet become a place of importance, as it is only thirty miles or so from the much talked of coalfields of the Grand Codroy Valley, and in summer Americans escaping from the hot cities of the States might find it a delightful place for sea-bathing, boating, and "ituna" fishing. At present it scarcely boasts of a hotel.

We were rather early for the salmon fishing in the east coast rivers, where the salmon and sea-trout don't begin to run up till the middle of July, but on the west they begin to run in June. We stopped at a farmhouse about two hours' run from Port Aux Basques, at the first good salmon river on the west coast, the Little Codroy River—a river running through a most beautifully wooded and picturesque country, at the base of the Long Range Mountains, where it takes its rise. When at Port Aux Basques, I asked the conductor of the train how far Little River Station was from Afton farm, where we were going. He said "three miles," but he added, "that is of no consequence, we can stop you opposite the house," so we and our luggage were dumped down

there accordingly, the whole of the inmates of the farm, male and female, being there to welcome us and carry our belongings. This seems to be a good deal the custom, and is very convenient. When we left we got our luggage down to the side of the line, and when we saw the train coming along, held up our hands, and were taken in, bag and baggage. The bell of the engine can be heard clanging a long way off, and so makes it easy for intending passengers to find out when it is coming. Passengers have even been known to chase a train, and be taken in when they were seen!

The Little Codroy River, besides being a lovely river for scenery, is a capital river for salmon and sea-trout, and fishes well from June to September. It is much frequented by Americans in the autumn season. We were only there for a few days, but got enough salmon and sea-trout to show how good it was. From the Little Codroy, we went over for a day to the valley of the Grand Codroy River, fifteen miles off. This is a noble river, with a great volume of water, and on its banks we found one Scotsman and several Englishmen encamped, salmon-fishing. The sport had not been so good as at Little River, and their catches had only averaged about fifteen salmon each in three weeks. I think the low state of the water kept the fish from running up. The river divides into two forks near the South Branch railway station. The lower parts of the Little and Grand Codroy near the sea are well settled, and the country more or less in cultivation of a sort. There seemed, however, great stretches of country on either side of these rivers capable of cultivation, but all at present under dense forest. It is in these valleys coal is said to have been discovered, but no one thinks of working it apparently, though there ought to be a fortune in it, if the seams are thick and of good quality. Following the line north, at not very long intervals there are three good salmon rivers running into the Gulf of St. Lawrence, viz., Crabb's, Robinson's, and Fischel's brooks (good large rivers are called brooks: another Devonshire derivation, I suppose), but as there is little or no accommodation to be had, it would be necessary for any one wishing to fish them to take a guide, camp equipment, and provisions. Away from the sea, the land alongside these rivers is covered with dense forest, and entirely unoccupied. I was told they were very seldom fished. Travelling on north, the railway took us to Bay St. George, where two fine salmon rivers run in, viz. the St. George River, and Harry's Brook. There are two small hotels here, as these rivers are much frequented by Americans in July and August, and also by people from St. John's. These are both splendid rivers, carrying a great body of water to the sea. We were rather early for the salmon fishing in June, as few fish had yet begun to run up. From Bay St. George a splendid excursion can be made right through to the east coast by those who are not afraid to rough it and camp out. East of St. George River they would strike the source of the great Exploits River, the largest river in the island, at the foot of the Anniespoquotch Mountains, over 2000 feet in height, whence a passage of eighty miles can be made by canoe, to the sea at Norris Arm (a railway station) on the east coast. From Bay St. George's we went on by train to Spruce Brook, and put up at "The Log Cabin,"

a sort of a hotel run by a Mr. Dodd, who is trying to open out a farm there in the wilderness, and meantime takes in salmon fishers, and caribou hunters, till he sees how his venture will turn out. It is beautifully situated, facing St. George's Pond, a lake nine miles long, and within a few yards of the railway, where all trains stop. Harry's Brook runs out of St. George's Pond, only a couple of miles from the house, the exit being a fine pool for salmon in the season. The scenery of St. George's Pond is lovely, the forest growing down to the water's edge, and the hills all round, except where Mr. Dodds' clearing operations have taken place, covered with forest to their summits. We rowed across the "pond" and walked by a trail to "Beaver Pond," where we caught a large number of the speckled trout of the country, and saw the haunts of the few beaver that still exist there; but Beaver was not at home, though we saw some freshly peeled branches which the guide said had been eaten by the beaver that morning. This pond lies on the way to the top of Grand Lake, fifty-six miles long, which can be reached by the forest trail in a few hours' walking. Our fishing on Beaver Pond had all to be done from a most substantial raft which the guide, Dennis Benoit, constructed that morning early, as there was no fishing-boat, and fishing from the sides of these small lakes is impossible, as there is no shore, the dense forest growing right down to the water's edge. I was very much struck everywhere in the island with the impenetrable nature of the forest. To go off a trail even for a few yards is risky, as in spite of the aid of a compass one might take a long time to get out. I was told the natives themselves lose their way occasionally. When one thinks that from St. George's Pond for more than a hundred miles as the crow flies to the south coast, there isn't a road or a dwelling of any sort, only lakes, rivers, and barrens, one can understand what an unoccupied country it is. No one should venture into a country of this sort without a guide, a good axe, plenty of matches, and some provisions. It is always easy to get up a fire, and thatch oneself from the cold at night with the branches of trees.

The next place we stopped at was the Bay of Islands, facing the Gulf of St. Lawrence on the west coast, and within a day's sail by steamer of the Straits of Belle Isle and Labrador. This is a beautiful scattered hamlet on an inlet running up for fifteen miles or so from the sea to the mouth of the Humber River. It is a very rising place, possessing a branch of the Bank of Montreal, a fine copper mine a few miles off, slate quarries, and fishing establishments for curing the ubiquitous cod. The village extends along the bay for several miles. There are churches here of all denominations, Church of England, Roman Catholic, Presbyterian and Wesleyan. As the local steamer for Port Aux Basques to Labrador calls here, one was strongly tempted to go in her to that wonderful country of high mountains, great rivers, waterfalls, and long arms of the sea, not to speak of the excellent salmon fishing to be had, but time would not permit. I may mention here what is probably not generally known, that the whole of the west coast of Labrador as far up as the Moravian settlement of Nain, and near the entrance to Hudson's Bay, belongs to the Government of Newfoundland, though of

course the exact boundary in the interior betwixt the province of Quebec and Labrador—Newfoundland, has never been clearly defined, or even explored. The Humber River, which runs in at the Bay of Islands, is probably the third largest river in the island. It pours an enormous volume of dark black water through a gorge in the hills under Mount Musgrave, along which the railway runs. As viewed from the line, it reminds one of the Pass of Killiecrankie, only the gorge is deeper and the river larger. Unfortunately, sparks from the engine had set fire to the dense forest, and for miles on either side of the gorge, and far inland, even on the north shores of Deer Lake, the forest was a scene of desolation. The destruction of forest by sparks from the

Fig. 2.—Scene on the Humber River.

engine has not been confined to this part only, for large tracts on the east coast have likewise been burned out, giving a most desolate appearance to the country, and it will be years before it clothes itself with a new growth. The railway, after it leaves the Humber gorge, runs along the south side of the magnificent Deer Lake for twenty-five miles. At the end of the lake, and on the opposite side from Deer Lake Station, the upper Humber River runs into it by two channels, both navigable for sailing boats for a mile or two from the lake, as far up as Nichol's farm. The river is here very wide, and so densely wooded that it reminds one of a large Ceylon or West African river, rather than a river in northern parts. Ingress or egress through the dense growth of alders is impossible even for a dog, except at places where boats are kept. These thickets are the home of dense clouds of mosquitoes and sand-flies.

Though it was only three o'clock in an early July morning when we sailed across to Nichol's farm from the railway station, the attacks of these pests were unanimous and combined. Not even in the jungles of Ceylon or India have I seen anything to equal them. The Nichols' is the only house of entertainment in these parts, the country for 150 miles north being still a wilderness of forests and lakes, and without a road of any sort. Nichol is the descendant of a Highland family that came from Inverness-shire. He farms his own land, and his sons act as guides in summer to the salmon-fishers who encamp at the Humber Falls, nine miles up from the lake. From Deer Lake the railway turns well inland towards the east, passing the corner of Grand Lake (fifty-six miles long) and on through a high country, passing two singular-looking mountains of no great height—"Gaff topsail, and Mizzen topsail"—names appropriate to a great fishing island, till it reaches Millertown junction, where there is a great lumber camp, and on down the Exploits River to Norris Arm Station, where the east coast is reached. Turning somewhat inland again, the line passes on to Glenwood, another lumber station, on a fine salmon river, the Gander, the second largest river in the island. Then following the line south-east come the salmon rivers Gambo and Terra Nova.[1] I fished the Gambo River, but was too early for the salmon, and only got baskets of speckled trout. I say *speckled*, because we have no trout in this country so peculiarly marked. The Americans give them the inappropriate name of "mud" trout. I visited the lake the Gambo runs out of, where on a tributary stream there is a great lumber mill, giving employment to a large number of men, but I was sorry to see that though they burn the sawdust and bits of sawn logs, large quantities of sawdust escape the fires and fall into this fine spawning river. Of course there is Triton Brook, another large river running into the head of Gambo Lake, where probably it is thought sufficient spawning ground is left.

In time the island will doubtless become a great pulp-producing country. The principal woods are spruce pines, birch, aspen, and white maple. On the barrens there are mosses and lichens, but, strange to say, no heather of any sort. Rhododendron rhodora and Linnea grow on the barrens in great abundance, and in swampy hollows great numbers of the singular pitcher plant.

Coming to within sixty miles of St. John's, we diverged at Placentia junction in order to visit the old French capital of the western district, Placentia. This is a place with a history. Judge Prowse says Charles II. sold Placentia and the western part of Newfoundland to Louis XIV., and it was from this time onwards "the French Shore question" arose, which has given so much trouble since, but, thanks to the late Government, has now been settled. From Placentia junction the railway runs through a densely wooded, and, though so near St. John's, still unoccupied country. The engineers seem to have skilfully availed

[1] Gambo, the village, lies at the head of a long arm of the sea, one of several forming Bonavista Bay, which claims the distinction of being the first land sighted by John Cabot in his discovery of the American continent in 1497.

themselves of a range of wooded hills, and ran along them till they reached the top of the north-east arm (a sea inlet), and then along it still following the range, till they arrived at Placentia Railway Station, overlooking the town. Coming out of the station on a fine July afternoon, Placentia presents one of the most charming scenes in the world, with its red roofs and huge Roman Catholic Church, more like an Italian than a colonial town. The town is partly built on the "north-east arm," and partly on the "south-east arm," as these two inlets of the sea are called. Two ferry-boats for the convenience of the public convey passengers back and forward betwixt the two sides of the town, free of expense, though some day a suspension bridge might obviate all

Fig. 3.—St. John's.

this. On the end of the ridge down which the railway has been taken to the steamboat pier, but high above the town, there are the remains of the old French fort which protected the town, the guns of which have long since disappeared. It is a pity the city had not been built of stone, as the original wooden houses will all disappear. The only stone building in the place is a convent, and that is of recent construction. The English church is crumbling to pieces, and the graveyard attached quite neglected. As there are only two Protestant families in the place, this is not surprising. Mr. Bradshaw, formerly Member of the Legislative Council for Labrador in the Newfoundland Parliament, and one of the two Protestant families, is the custodier of a splendid copy of the Scriptures and Psalms printed in 1783, and a Communion service presented to the church by William IV. in 1787 after a visit to the island.

The sides of the north-east and south-east arms are partly cleared and cultivated. I walked some way up the south-east river, seven miles from Placentia. It is a very pretty little salmon river, but at that time, 7th July, the water was too low, and the sea-trout and salmon were waiting for a flood before ascending. Accommodation can be had at Folford's, a small farm. It is a lovely place to stay and make excursions from, as it is on one of the few carriage roads leading to St. Mary's Bay, and the rivers Branch, Colinet and Salmonier, all in the peninsula of Avalon. These are three of the best sea-trout and salmon rivers on the island, especially the last. The famous Cape Race is also situated on this peninsula sixty-four miles south of St. John's. Why all the country south of the railway leading to Placentia has not long ago been occupied is most surprising. The hills are not high, and except on the eastern side, near the coast, are completely clothed with forest. The proximity of the capital, St. John's, would afford a ready market for any produce the people had to send, dairy or otherwise. If Siberia can produce and send to this country enormous quantities of butter, much more Newfoundland, if she could only get more land into cultivation. Returning back by the line from Placentia, we stopped a short time at a very pretty village close to some good trout lakes called Whitbourne, where there is a nice hotel, and then on to Holyrood, another pretty village at the head of an arm of the sea on the east coast, thirty miles from St. John's. From there we drove twenty-one miles to the mouth of the Salmonier River (pronounced Salmoneer by the natives), where it runs into the sea on the south-east coast. Here again, except at and for two miles or so out of Holyrood, with the exception of two small farms, Walsh's and Murphy's, the narrow road runs through an undulating country of dense forest, with lovely small lakes every here and there close to the road, all said to be full of trout. There are two famous salmon falls, Murphy's and Pinsent's, on this river. Our destination was Pinsent's, where we meant to fish for salmon, as we heard they were running up in great number. We procured a guide at a house near the sea, and then retraced our steps for four miles to the turn-off to Pinsent's falls. There was no road, only a frightful trail, through dense forest. Fortunately it was only a distance of two miles, but owing to the very swampy nature of the ground, and the fallen trees, it took us more than two hours to accomplish what could easily have been done in three-quarters of an hour. We put up in a small wooden shanty, roofed with bark, close beside the falls. Two young men from St. John's, who were fishing there, kindly invited us into their hut for supper till our guide got things fixed up in our hut. They had been there for less than a week, and had caught over seventy salmon in that time! The next morning we were up at 3 o'clock A.M., and down beside the falls. When daylight was fairly in we could see the salmon rising in the pool below the falls everywhere. The salmon there are unsophisticated, and have no such bashful feelings as are attributed to them by Mr. Philip Geen in his recent book, when he warns fishers to keep well out of sight in the River Lyon. Three rods fishing at short intervals in the same pool would often have each a fish on at the same time. With a very short line I hooked with fly,

on several occasions, and landed it, a fish rising not more than five yards from where I was standing. The salmon on this river during the time the run was on, a matter of about three weeks, from 15th July, were literally passing up in thousands. The Salmonier is only a sample of the splendid salmon rivers that abound all round the island. There are many rivers in the south and north that are never visited, except it may be by the natives or by those willing to camp out, as there are no roads, and the only means of communication are steamers calling at certain

Fig. 4.—Products of Newfoundland.

particular points on the coast, and even then, from these it would be necessary to have guides and a row-boat to reach them properly.

Besides the fishing there is splendid caribou shooting in the autumn to be had in the neighbourhood of Grand Lake, and many other parts of the island. Many sportsmen from the States, and a few Englishmen, are finding their way there for that purpose. Mr. Dodd of the "Log Cabin" can procure guides and fit out expeditions. The caribou shooting, unlike the fishing, is not free to strangers, who must pay a licence fee of $50, and for that they cannot kill more than three stag caribou, but as

they are such splendid animals, most people would be content with three heads.

The island will now, I think, waken up. The great want is population. If emigrants of the right sort, with some capital, could be induced to take up land and open it systematically, something might be made of it. The inhabitants along the coast are principally engaged in the fisheries, and they only seem to scrape the soil in little patches: there is no attempt to farm on a large scale, except in the neighbourhood of St. John's, where the country is well cleared. In the neighbourhood of the Little and Grand Codroy rivers and in the neighbourhood of St. John's we saw grass of the richest description, also fine fields of potatoes and cabbage, the latter, it is said, being the national dish. The difficulty with agricultural immigrants is the expense of clearing the forest. All through the Eastern States of America, New Brunswick, and Nova Scotia there seemed to me to be vast tracts of unoccupied land, but so long as there is abundance of prairie land in Western Canada requiring no clearing, the forest lands will not be much sought after.

I have merely written this article to draw attention to a very interesting country and one that, with good government and liberal land laws, should very shortly come to the front. The colony has at the present time a Governor, in Sir William Macgregor, of the right stamp, and there are many able men who were, in past governments as well as in the present, well able to advance its interests.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings in February.

On the 13th February, in the Free Assembly Hall, Dr. Charles Sarolea, D.Ph., D.Litt., addressed the Society on his travels through "Russia and the Caucasus," Dr. John Horne presiding. On the motion of Mr. Ralph Richardson, the Lecturer was awarded a vote of thanks for his Address. Dr. Sarolea repeated his Address on the 14th February before the Glasgow Centre, Professor A. E. Maylard occupying the Chair.

On the 15th February, before the Dundee Centre, Mr. Thomas Murdoch, F.G.S., delivered a Lecture entitled "Ceylon, the Pearl of the East," Sir John Leng, LL.D., D.L., J.P., presiding.

At Aberdeen on the 16th February, Mr. Charles J. Wilson, F.R.S.G.S., lectured on "The South African Colonies as seen by the British Association in 1905," Ex-Lord Provost Fleming, L.L.D., of Dalmuinzie occupying the Chair.

On the 22nd February, Major Ronald Ross, C.B., F.R.S., D.Sc., F.R.C.S., delivered a Lecture entitled "Science and the Public," Brigade-Surgeon Lieut.-Colonel James Arnott, M.D., President of the Society, presiding.

Major Ross repeated his Address before the Glasgow Centre the following evening.

Sir Charles N. E. Eliot, K.C.M.G., C.B., repeated his Lecture, "From Mombasa to Khartum: through Uganda and down the Nile," before the Dundee and Aberdeen Centres on the 27th and 28th February respectively. Mr. I. Julius Weinberg, J.P., F.R.G.S., Chairman of the Branch, and the Very Rev. J. Marshall Lang, D.D., LL.D., Vice-Chancellor and Principal of the Aberdeen University, respectively occupying the Chair.

CORRESPONDENCE.

The Policy of a Free International Interchange of Geographical Knowledge.

To the Editor, *Scottish Geographical Magazine.*

Sir,—At the International Geographical Congress, held in London in 1895, a number of resolutions were passed, two of them, Nos. 7 and 8, relating to the importance of (7) a Topographical Survey of Africa; (8) a Production of a Map of the World on a scale of 1 : 1,000,000.

To give effect to the proposals for carrying out these projects, it was generally acknowledged that definite international co-operation would be required, and that efforts should be made by the various geographical societies of the world to secure the acceptance of the principles adopted by the delegates to the Congress, with reference to these subjects.

The two subjects named above were among the most important discussed by the Congress, but the list of contents of the report indicates the wide range of subjects brought forward, and makes it clear that the only satisfactory way of dealing with geography is by abolishing political boundaries and by reducing national jealousies to a minimum, in its consideration.

In 1903, Sir Clements Markham and Sir T. Holdich, President and Vice-President, Royal Geographical Society, both wrote papers pointing out the benefit that would result to the world in general from the publication of geographical material in possession of the Government of India; their papers were forwarded to the then Viceroy, Lord Curzon, and at a later period, Lord Lamington, the Governor of Bombay, was specially interested in the matter, but, so far as can be ascertained, no result has followed.

Early in 1905 a suggestion was made to H.B.M. Ambassador in Paris, that a free exchange of geographical information between England and France might be arranged. This proposal was submitted to our Foreign Office, and a decision was given that it could not be sanctioned.

These attempts having failed, it is necessary to consider what other steps can be taken to secure the adoption of the liberal policy advocated ten years ago by the International Geographical Congress; and, first, it is necessary to face the difficulties which stand in the way of the adoption of such a policy by Great Britain. These are:—

(i) The failure on the part of the public to accord to Geography, as a science, the importance it deserves, and to recognise its usefulness as a national study, a failure in which the Government necessarily participates.

(ii) The lack of a clear definition as to what is meant by geographical information, and the confusion with it of topographical material, some of which may rightly be considered secret.

(iii) The objections raised by the War Office and the India Office to the interchange of information with other nations, and their hesitation to incur responsibility in the matter.

(iv) The impossibility of a Government department assuming the task of map-making for the public, though a cartographer, as a Government agent, is allowed to publish certain authorised issues of Government material. The War Office and the department of the Surveyor-General of India have only a limited sum at their disposal and cannot undertake the diffusion of geographical knowledge as well as the accumulation of material.

My suggestion is, that the geographical societies of Great Britain should unite in formulating a definite policy, based on the principle that Geography knows no boundaries, and might request the Foreign Office to approve the formation of a responsible committee, on which these societies, as well as the War Office and the India Office, should be represented, to direct and control the issue of such geographical material as any of the Government departments may receive.

This committee might advise the Government as to an international exchange of geographical matter. It should encourage the development of cartography, and assist in the production of maps and the general diffusion of geographical knowledge.

E. F. CHAPMAN.

BEECH HURST,
LINGFIELD, 30*th January* 1906.

GEOGRAPHICAL NOTES.

EUROPE.

The Lagoon of Venice.—M. Favaro, the President of the *Reale Instituto Veneto di Science, Lettere ed Arti*, informs us that the Institute has decided to commence a systematic scientific study of the geo-physical phenomena which concern directly and indirectly the lagoon of Venice.

With this object a special committee has been appointed, and the preliminary investigations, bearing principally on the tidal waves in the upper Adriatic and the rivers flowing into it and into the lagoon of Venice, have been intrusted to Dr. Giovanni Piero Magrini, who is to be assisted by Professors Luigi de Marchi and Tullio Gnesotto of the University of Padua.

Asia.

Journey from China to India.—The Indian papers give some account of a journey made by Count de Lesdain and his wife from China to India, *viâ* Tibet. The journey was by way of the Gobi Desert, and the travellers then made a circuit round Koko Nor, and reached the salt swamps of Tsaidam. They next visited the sources of the Yangtse, and entered a region absolutely devoid of human inhabitants. For seven weeks here they did not meet a single human being. They passed a succession of lakes until they came to Tengri Nor, and on reaching the Sanchu river, followed its valley to a point near Shigatse. The journey into India was continued by Gyantse and the Chumbi valley.

Africa.

Ruwenzori.—In the *Times* for January 13, Mr. Douglas Freshfield gives an account of an attempt made by himself and Mr. A. L. Mumm with a Swiss guide last November to scale Ruwenzori. The attempt was a failure, the weather proving quite unsuitable, but Mr. Freshfield is of opinion that the mountain will be conquered before long. June and January are, he believes, the two most suitable months for making the attempt. He finds that trees grow up to 15,000 feet, and one native pass which goes through the heart of the chain, and must be over 14,000 feet in height, does not touch snow, so that the snowline cannot be said to be at 13,000 feet. The glaciers have no drainage streams, but merely waste away. The extent of the snowy range at Ruwenzori has, Mr. Freshfield believes, been greatly exaggerated.

The Fayum Province of Egypt.—We have recently received a well-illustrated monograph on the topography and geology of the Fayum by Mr. H. J. L. Beadnell. The Fayum region has a double interest for geographers and geologists. It first of all includes in the Birket el Qurun the last remains of the ancient Moeris, used by the Egyptians as a regulator for the Nile floods; and secondly, the area has recently become of great importance owing to the discovery there of some very interesting fossil vertebrates, one result of which has been that Dr. Andrews has been enabled to settle the difficult problem of the origin of the elephant. The present report is, therefore, of considerable interest. The general conclusion is that the Fayum region, which has an area roughly speaking of 12,000 square kilometres, has been cut out by the action of the ordinary subærial denuding agents, and has not, as has been supposed, originated by earth-movements.

Polar.

The Argentine's Antarctic Stations.—The Argentine exploring ship *El Austral* left Buenos Ayres at the end of December, carrying with her a party of three scientists and a steward, under the direction of Señor Lind, to continue the work initiated by the Scottish National

Antarctic Expedition for a fourth year, at the meteorological and magnetical station at Scotia Bay, South Orkneys. The ship *El Austral*, after landing this party, will return to Ushuwaia, Tierra del Fuego, from the South Orkneys, with the party which has been stationed there during the past year. Meantime Mr. Angus Rankin, late superintendent of the Ben Nevis Observatory, and three companions are on their way by mail steamer to Ushuwaia, where they will join the *Austral*, and proceed southwards to Wandel Island, Graham's Land. Here Mr. Rankin will establish, at the south end of Gerlache Strait, south of 65° S. lat., a new Argentine Antarctic meteorological and magnetical station. On the return of the *Austral* to Buenos Ayres, another of the late Ben Nevis Observatory staff—viz., Mr. R. H. MacDougall, will be embarked for the island of South Georgia, where a third station is to be set up. This forms the largest and most important series of Polar meteorological stations working in co-ordination since the great international Polar project of 1882-83.

A New Antarctic Expedition.—It is announced that Dr. Charcot and the well-known aeronaut Comte de la Vaulx, have decided to make an attempt to reach the South Pole, with the combined assistance of a ship, a balloon, and a motor sledge. Dr. Charcot estimates that the preparations for the expedition will occupy about eighteen months.

M. de la Vaulx's idea at present is to choose a base of operations and thence to make a first trip of some 25 to 30 kilometres. He would take with him in his balloon an automobile sledge. At a suitable spot he would descend and there establish a fresh base of operations. He would then return to the original base by sleigh. The second trip would be a longer one. Again he would descend and establish a fresh base, and again he would return to the original base, and so on until he reached the Pole.

General.

Vacation Course in Geography at Oxford.—We are informed that a course of lectures and practical work in Geography for teachers and others will be held in Oxford between August 7 and 25, if a sufficient number send in their names before June 1. Application should be made to the Reader in Geography, Old Ashmolean Building, Oxford.

The Association of American Geographers.—Mr. A. P. Brigham has furnished us with the following note :—

The second annual meeting of the Association of American Geographers was held in New York City, December 26-27, 1905, under the presidency of Professor W. M. Davis, of Harvard University. The American Geographical Society generously offered the use of its building at No. 15 West 81st Street, and served luncheon to the members present on both days of the meeting. The annual dinner was held at the Hotel Endicott on the evening of December 26. The several phases of geography, particularly the organic, physiographic, and educational, were well represented. About twenty-five papers were read by their

authors, and others were read by title. About forty members and invited speakers were present.

The Association does not sustain any regular publication. Through the courtesy of the American Geographical Society, their bulletin for February of this year is mainly devoted to the proceedings of the meeting.

The officers selected for 1906 are as follows: President, Cyrus C. Adams; 1st Vice-President, Angelo Heilprin; 2nd Vice-President, William Libbey; Secretary and Treasurer, Albert P. Brigham; Councillors, 3 years, W. M. Davis; 2 years, I. C. Russell; 1 year, H. C. Cowles.

The Exploration of the Indian Ocean.—Mr. Gardiner, who has now returned to England, communicates to *Nature* an account of his exploration of the Seychelles Archipelago, where he and Mr. Cooper spent seven weeks, at the close of their cruise in the *Skylark* (cf. p. 106). He finds that the islands of the Archipelago rise from a marine bank running more or less east and west, and measuring about 190 miles by 100. The bank has an average depth of thirty fathoms, and has a contour similar to that of typical coral reefs and banks. An outer rim is indicated along the whole of its north-western half by a series of shallower soundings, but to the north-east the depth does not markedly shoal. It has two typical surface-reefs with coral islets to the north, Bird and Dennis, but elsewhere the rim is generally covered by at least seven fathoms of water. Between these two islands, and to the west of Bird, the character of the bottom is somewhat similar to that found at the edges of the submerged Saya de Malha and Nazareth Banks, and indicates the upgrowth of a rim. The fauna was more varied, but the bottom was less covered by nullipores and corals, and a few green algae were abundant. All sedentary organisms were covered with dirt and unhealthy between Bird and Dennis Islands, where there would appear to be a natural outfall for the tidal and other currents. In this position there is certainly no upgrowth of the rim, while elsewhere it must be exceedingly slow. The bottom within the rim is sand, muddy sand, or mud, the latter held together by the roots of algae. Strong currents sweep across it, and even in dead calm weather, the sea-water was always cloudy, so that, except in favoured spots, corals could scarcely grow up into reefs.

The islands of the Seychelles naturally divide themselves into two groups to the west and east, with Mahé and Praslin as centres. The former comprises Mahé, Silhouette, and North, with a series of small islets around the first, outlying buttresses and peaks of the same, with only a few fathoms of water between. Praslin also is similarly surrounded by a series of tiny islets and rocks, but in addition there are eleven other islands in its group separated by considerable channels. Mahé and Silhouette attain heights respectively of 2993 and 2467 feet, but Praslin and the eastern islands do not exceed 1270 feet. All islands were found to be formed of similar coarse granites (or granulitic quartzes), with narrow, vertically extending dykes of finer grained black rock, apparently a variety of granite, along which the mountain streams have invariably cut their courses. In addition, many of the islands have

against their coasts, in bays and suitable situations, flats of sand, largely coraliferous. Some of these have doubtless been formed by a washing up of the sand from the sea, and some are, partially at least, of delta formation, but in places there is evidence of a recent elevation of more than 30 feet. Besides this, there are indications (particularly in Mahé) of an ancient elevation of upwards of 200 feet. Marine action prior to its occurrence perhaps accounts for the almost continuous line of precipices, which at various distances from the present coast extends along the eastern or windward side of Mahé. The question, however, requires further investigation. In any case, the deep cañons of many of the mountain brooks, and the very extensive weathering of the granites, indicate the not inconsiderable antiquity of the land as such.

Barrier reefs nowhere exist around the islands of the Seychelles Group, and fringing reefs only in certain somewhat protected situations. Mahé Island extends more or less north and south, with two conspicuous points to the west. A fairly continuous reef lies along its east side, but there is no reef off its north and south points, and reefs only occur in the bays of its western side. Silhouette is a round island with practically no reef, while Praslin has reefs in its bays alone. La Digne, Curieuse, and the smaller islands have merely patches of reef. On examining into the causes of this, the party found a luxuriance of coral growth even off the points of the islands, but practically a complete absence of nullipores. Indeed, these calcareous algae are essential in the Indian Ocean for the consolidation of corals into true reefs. Where fringing flats actually do occur, they would appear generally to consist of a basis of granite rock with quite a sparse covering of calcareous matter, or to be a filling in with the remains of some of the reef organisms between masses or islets of granite and the land. The boat passages through the reefs are in most situations mere outfalls for the tide, and show no connection with the fresh-water streams off the land. Small mangrove swamps occur on the seashore, but behind these the land has been almost completely cleared for the cultivation of cotton, coffee, cassava, cocoa, and vanilla to the height of 1500 feet. Below this there are only a few isolated endemic trees, and above there are in patches in the jungles large numbers of oranges, limes, citrons, and cinnamons, with an undergrowth of the Mauritius raspberry—all introduced plants. Indeed there are, except in Silhouette, only a few summits and precipitous slopes which have not been at one time or another completely planted, and it seems possible that even these may be destroyed within a few years for the cultivation of various rubbers. Such jungles as now remain consist mainly of palms (Roscheria, Stevensonia, Nephrosperma, Verschaffeltia), various screw pines (Pandanus), Dracaena, and the bois rouge (Wormia), with bare ground beneath covered by their strong leaves. Open spots, however, have a dense undergrowth of ferns, Lycopodia, Selaginella, Psilota, and mosses, which also cover the lower parts of the trees. In effect, it is a typical tropical, moist forest undergrowth, noticeable mainly for the comparative absence of climbing plants and herbaceous dicotyledons, and for the fact that nearly all the larger trees are peculiar Seychelles species, and often genera. Most of the giant trees (Maba,

Stadtmannia, Afzelia, Campnosperma, etc.) have been singled out and cut, but bare stems of capucin (*Northea seychellarum*) stand up everywhere above the foliage. The destruction of the latter, which probably will shortly be complete, was discovered to be due to a green beetle, which deposits its eggs singly in the new leaf-buds, the resulting maggot consuming all their softer parts.

The most interesting feature in the botany was the sharp distinction of the cotyledonous plants into three classes, the calciphilous, the siliciphilous, and the indifferents, the latter forming a smaller percentage of the whole than either of the other two. The calciphilous species are practically the same as those found on all the coral islands visited, and are scarcely more numerous. This group of plants was probably ocean-carried, the Seychelles being in respect to it as oceanic as any island of the Chagos Archipelago. Moreover, of the other trees many seem to possess seeds, which could have been brought by currents, etc., to the islands. The finest individual species of trees was the coco-de-mer, or double cocoa-nut (*Lodoicea seychellarum*), which is peculiar to Praslin. Its palms are either male or female, and an examination of more than three hundred of its nuts showed that they are of two distinct, structurally different forms in approximately equal proportions, both kinds growing on the same female tree.

The fresh waters consist of certain pools near the sea and a large number of tiny mountain streams, which become roaring torrents in the wet season, but never dry up.

The number of species of land and fresh-water animals would, on the whole, appear to be singularly few, and individuals were, with a few exceptions, by no means abundant. Their small variety may be due to the comparatively few plants which grow in the islands, but Mr. Gardiner is inclined to question the former connection of the group with any larger land mass.

Commercial Geography.

The Nile-Red Sea Railway.—The railway between Port Sudan, the new port on the Red Sea, and Berber, was formally opened by Lord Cromer on 27th January. The railway was not finally started until October 1904, and thus, counting to the formal opening, it has been constructed in under sixteen months. Port Sudan (Bander Sudan), the port which has been chosen in preference to Suakin (cf. this *Magazine*, xxi. p. 156), is thus now linked up with Atbara and the Nile, for though theoretically Suakin is the terminus of the new railway, yet it is connected with the new port by a loop line. There seems reason to believe that the advantages of the new port are such that it will tend to develop at the expense of Suakin, which will probably decline.

British Central Africa.—A Parliamentary Paper (Cd. 2684-18) has been issued containing the annual report of the British Central Africa Protectorate for 1904-5. The revenue, which amounted to £67,537, was below that of last year, though above that of any year

before 1903; the expenditure amounted to £123,000, an increase of £20,000 over last year. The Protectorate is in most respects making steady progress. The export of coffee amounted to a total of 1,303,655 lbs., valued at £27,159, a higher figure than for any year except 1900. The experiments with cotton are being successfully prosecuted in the lowlands along the Upper and Lower Shiré river, though the highlands are not found so suitable. Over 200,000 lbs. of tobacco were grown, of which, however, the bulk was consumed locally. Expert American curers are being introduced, and great hopes are entertained of the future of this industry. Successful experiments are also being made with rice, rubber, and tea. The ultimate success of all these industries, however, depends on the completion of the Chiromo-Blantyre Railway and its eventual extension to Lake Nyasa. The prospects of the completion to Blantyre are now very hopeful, and the Port Herald to Chiromo extension is already in operation. The township of Zomba is now supplied with electric light. The only political event of any significance during the year was the taking over of the direct administration of the district known as Mombera's Angoniland by friendly agreement with the Angoni chiefs.

Projected Railway in the Zambesi Valley.—According to a note in *Le Tour du Monde* for December 23, the Portuguese Government have decided to undertake without delay the construction of a new line of rail in their East African possession. The new railway is to start from Quilimane and to run to Port Herald, following a course nearly parallel with the Zambesi. It will have a length of 246 kilometres (153 miles), and it is expected that it will prove a commercial success from the outset, for the Zambesi as a means of communication has many disadvantages.

Railway Enterprises in Argentina and Bolivia.—The British Chargé d'Affaires at Buenos Ayres reports that an Argentine syndicate has just obtained a concession from the Bolivian Government to construct a railway of one-metre gauge from Santa Cruz eastwards to Pedro Suarez, where a port is to be made on the Bolivian side of the river Paraguay, opposite Corumba (Brazil). The line would be 620 kilometres (385 miles) long, and entirely in Bolivian territory. The Argentine Government are negotiating with the Bolivian Government for a connection in Bolivia, from Potosi, with the Argentine Central Northern Railway, a Government line which is now being rapidly constructed northwards from Jujuy to the Bolivian frontier. This would give an outlet to the south of Bolivia into Argentina, while the railway which the Argentine Syndicate propose to construct would give an outlet to the east of Bolivia. It is pointed out that these two routes will be a set-off to some extent to the railway from Arica to La Paz, which will give Bolivia a direct outlet westwards to the Pacific coast. When the Panama Canal is completed, the Arica-La Paz Railway will be in a still stronger position to compete with trade routes *viâ* the River Plate and South Atlantic.

NEW BOOKS.

ASIA.

Jungle Trails and Jungle People. By Carpin Whitney. T. Werner Laurie, 1905.

The lust of adventure is the acknowledged motive of this book, and it is true to its underlying motive. The author writes with great vivacity, and interest never flags. Time is mostly spent in Siam and Burmah. Mr. Whitney is a true sportsman, both in the courage and resource he manifests in his journeys to the haunts of the lone game of the forests, and his care to kill and not to wound. His eyes are observant of the ways and customs of the natives of the regions through which he passes, and he generally speaks well of them. A map would certainly have proved helpful in following the steps of this devoted son of Nimrod.

Great Japan: A Study of National Efficiency. By Alfred Stead. London: John Lane, 1905. *Price* 10*s.* 6*d. net.*

Lord Rosebery contributes what is termed a foreword to Mr. Stead's book. The apostle of efficiency is not optimistic. We have muddled through so often successfully that we are indifferent to any other secret of achievement. Three things may move us, the most agreeable of which is a stimulating example such as is provided by Japan. And, indeed, to read Mr. Stead's book has certainly a stimulating effect. The progress of Japan within the last quarter of a century is so unique, is so entirely at variance with Eastern ideas of the slow march of civilisation, that we are compelled to revise our whole conception of national possibilities.

Two qualities stand out prominently in the Japanese character. The one—Patriotism—is insisted on by Mr. Stead as the corner-stone of the nation's existence. Inculcated both by their religion, Shintoism, and by their ethical code, Bushido, it animates as a continual motive power all ranks and conditions of the people. To the quality of patriotism the Japanese combine an extraordinary facility for detail and power of application. This is indicative of the logical type of mind, and results in great power of organisation and correctness in translating ideas into practical effect. Their methods of government, their system of education, their organisation of the army and navy, their fostering of industries, their improvement in the methods of agriculture, all point to the possession of the same qualities, and the story of these as told by Mr. Stead possesses the reader from the outset and compels his admiration.

Mr. Stead is frankly and unreservedly an admirer, and perhaps one might desiderate a larger element of criticism, or at least a greater sense of the limitations to which even the qualities of the Japanese are subject. Facility for detail and thoroughness in execution do not always imply high powers of initiative, and the criticism of outside naval and military authorities seems to indicate that in the recent war the Japanese leaders failed to take advantage of new situations after their original plans had been successfully carried out. Mr. Stead makes a strong defence of the Japanese attitude on the moral question, and also as regards their commercial honesty. The fact that the former is, from the English point of view, beyond argument illustrates the difference which exists between the civilisation of a nation like the Japanese and that of our own country, which has been evolved through long centuries of gradual progress. On the subject of commercial honesty the fact remains that the experience of private traders up till now has not been uniformly satisfactory. It would be unfair, however, to judge the nation by

individual cases, and in a country in which the Government has so high an ideal of straightforward dealing, and such advanced views in regard to humanity in war, the standard of the individual must tend to rise. Mr. Stead does not exaggerate the importance of Japan's entrance as one of the great nations of the world, and his confident opinion that its influence will be directed towards peace and industrial progress will be generally accepted by the nation which is bound to her by ties of friendship and alliance.

History of India. By C. F. de la Fosse, M.A. London: Macmillan and Co., 1905. *Price* 2*s.* 6*d.*

This is a most careful and valuable piece of work. It is a necessarily rapid but lucid and interesting survey of India and its peoples from the prehistoric age of the Kolarians to the close of the nineteenth century. It throws a clear light on the nature of the Aryan Migrations, on the origin of Caste, on the rise and decline of Buddhism, and on the successive rule in India of Pathan, Mogul, Mahratta, Sikh, and Briton. The maps are a great help to the narrative. The ignorance of most of our countrymen about India, our great Eastern dependency, is proverbially colossal, but this little book does much to make the continuance of such ignorance without excuse. It is strongly to be recommended for its clearness, for the justice of its proportions, and for its impartiality. It is to be hoped that it will have many readers.

AFRICA.

The Guide to South Africa for the use of Tourists, Sportsmen, Invalids, and Settlers. 1905-6 edition. Edited by A. Samler Brown and G. Gordon Brown. London: Sampson Low, Marston and Co., Ltd. *Price* 2*s.* 6*d.*

This, the thirteenth, edition of this useful little guide has recently reached us. Like its predecessors, it contains in compact form an enormous amount of information in regard to South Africa, arranged so as to be of easy access. The index, so far as we have tested it, appears to be quite satisfactory, while the maps are clear and simple, and adequate for the purpose for which they are intended. Further, in spite of the very moderate price, the printing is clear and good, so that the volume may be cordially recommended to any one interested in South Africa.

The Source of the Blue Nile. By A. J. Hayes, L.S.A. Pp. 315. London: Smith, Elder and Co. 1905.

In spite of the number of African travellers who have published their experiences during recent years, the glamour of the unknown still lingers about the Dark Continent. It is to be feared that this can scarcely outlast the present generation, since rail and steamboat are rapidly opening the way for the all-pervading globe-trotter.

Dr. Hayes, however, has contrived to give us a fresh and entertaining volume, with sufficient of general interest to make it interesting to the public, while his close observation gives a fair amount of reliable information to those interested in anthropology, botany, and various other subjects, noticeably entomology. Dr. Hayes has even brought home a small collection of insects, which he has presented to Oxford. Hitherto few travellers appear to have attempted any botanical collection, though Dr. Hayes' references, together with his quotations from Mr. Dufton, lead us to suppose that there is a large field in this direction.

We cannot but note as an extraordinary instance of the short-sighted policy of

the British Government, that although almost every traveller through these regions has pointed out the suitability of much of the Sudan for cotton-growing, no attempt has yet been made to encourage what might be a source of wealth to both natives and colonists. Presumably we are waiting for Germany to turn her attention to the subject!

Dr. Hayes gives us an extremely interesting review of the Abyssinian Church and its ancient traditions. The text throughout is accompanied by excellent illustrations, and there are good maps.

A Yankee in Pigmy Land. By William Edgar Geil. With 125 Illustrations. London: Hodder and Stoughton. 1905.

Across Africa, from Mombasa in the east to Banana in the west, is still a big journey. As the route followed, though not as the crow flies, deflected but a few degrees to each side of the Equator, it will be understood that Mr. Geil's travels were pursued under climatic and other difficulties. Written in a sprightly vein, and with a practised writer's mastery, the narrative never fails to interest, and fascinates still more as we proceed.

Well equipped as to outfit calculated to facilitate travel in the African Equatorial, the author, sailing from Bombay, broaches "the dark continent" at Mombasa, availing himself of the railway to Victoria Nyanza. The journey from the ocean to the great inland lake is overtaken in stages, and his impressions of the inhabitants, the scenery, and the products of the lands traversed are recorded. He notes alike the virtues of the natives and the defects of their qualities.

Crossing the big ford of the Voi, the evangelising work engaged in at Sagalla, Nairobi, Kiable, and Nakenya, comes under review. The railway, reaching its highest elevation, 8320 feet, descends, terminating at Port Florence on the Victoria Nyanza. The great inland lake, the second largest in existence, 250 by 200 miles, thickly islanded in the north, with its hippos and other inhabitants, is described. Round the lake sleeping sickness, that mysterious scourge of Africa, believed to be imported up the Congo, more or less prevails. On a peninsula stands Entebbe, the administrative centre of Uganda, with its five millions, including a number of Mohammedans and French Catholics, the latter claiming large accessions of converts. The Mountains of the Moon are also visited, round and up the Ruwenzori range, that region of thunderstorms, boiling springs, and extinct craters. Christian missions are here in evidence. Crossing the Simliki Valley, the Pigmy forest is traversed towards Aruwimi. Mr. Geil's account of the human midgets there met is exceptionally full and informing. His forest experience, though not uniformly agreeable, had ample compensations for the ardent ethnologist. Of the bronze-coloured, cleanly, sweet-voiced, funny little folk he has much good to say.

In his progress from Stanley Falls, cannibalism, witchcraft, fetish beliefs, the noble work at Yakusi of the English Baptists, the judicial administration of the Congo Free State, and his intercourse with officials, are discussed. Testimony is borne to the worthy efforts made by medical science to cope with sleeping sickness, which prevails all along the Congo, more especially, however, at its lower reaches. Travelling by dug-outs, by rail, by steamer, and again by rail, the author reaches Banana, having accomplished a journey which gives him the right to speak authoritatively on Equatorial Africa.

The volume is profusely illustrated with good photographs, and also interspersed with pictures, not photos, which cannot be commended. A somewhat serious defect is the absence of a good map with the route traversed indicated.

AMERICA.

The St. Lawrence River: Historical, Legendary, and Picturesque. By George Waldo Browne. Pp. 365. *Price* 15*s.* London and New York: G. P. Putnam's Sons. 1905.

Written in a popular style, illustrated with many beautiful views from photographs, and with a large clear map, this book should attract all interested in the river which the Indian, when asked its name by Jacques Cartier, termed "A river without end." "It has its source," says Mr. Browne, "in the largest body of fresh water upon the globe, and, among all of the big rivers of the world, it is the only one whose volume is not sensibly affected by the elements." He gives an interesting account of Cartier discovering in 1535 the Red Indian capital of Hochelaga, and of his scaling a mountain close to it which he at once named "Mont Royale," now converted into Montreal. Cartier was a Breton who sailed from St. Malo, and entering the Strait of Belle Isle discovered a small harbour which he christened "Saint Laurens," the first appearance of the name which, as St. Lawrence, was later applied to both gulf and river. Only one copy of his map of 1544 and his *Bref Récit* of 1545 have been preserved, the first in the Paris Library and the second in the British Museum. In 1603 Samuel de Champlain, a native of Brouage on the Bay of Biscay, sailed up the St. Lawrence to found "New France," and although the Sieur de Monts obtained the grant and was made Lieutenant-General of the vast territory stretching from the St. Lawrence to Cape May, known under the name of L'Acadie, it was Champlain who in 1608 carried the pioneer colony to Quebec, which he founded a year before Hudson sailed from Amsterdam and discovered the river which bears his name. In 1609 Champlain discovered Lake Champlain. It was not till 1620 that the Pilgrims landed at Plymouth Rock, but the two infant colonies which were now in North America were destined to become intense rivals in years to come. The next great hero of Canada was Frontenac, who waged a series of campaigns against the English and Indians, and who died in 1698, leaving New France at the high-water mark of prosperity and power, although its population did not exceed 30,000. In 1756 France sent one of her ablest commanders, the Marquis de Montcalm, to lead her battles on the St. Lawrence. Three years later the immortal General Wolfe and a British fleet appeared before Quebec, which was held by Montcalm, and in the memorable battle which followed, and which led to the British capture of Quebec, both Wolfe and Montcalm met their deaths. A year later De Levis surrendered Montreal to the British, and by the Treaty of Paris in 1763 Britain became mistress of North America. In the work before us Canada's history is graphically narrated, and the often marvellously beautiful scenery of the St. Lawrence is finely described.

A Historical Geography of the British Colonies. Vol. II. The West Indies. By C. P. Lucas, C.B., of Balliol College, Oxford, and the Colonial Office, London. Second Edition, revised and brought up to date by C. Atchley, I.S.O., Librarian of the Colonial Office. Oxford: The Clarendon Press, 1905.

This volume was reviewed in our pages on its first appearance in 1900 (cf. vol. vii. p. 283). The present edition is practically not increased in size, but the statistics have been brought up to date, new references added, and similar improvements made. In its modified form the book deserves to enter upon a new career of usefulness and prosperity.

AUSTRALASIA.

Australian Life in Town and Country. By E. C. Bulez. 1905. London: George Newnes, Limited. *Price* 3*s.* 6*d.*

The fourth volume of the "Our Empire" series is devoted to "Australian life in town and country," and in interest and literary merit is quite as good as any of its predecessors in the series. The writer is evidently well acquainted with his subject, and his sketches of town and country life, more especially the latter, are often vivid and graphic. A perusal of this work may serve to cause some of us at home to reconsider our accepted ideas of what we think of Australia, and still more, of what Australia thinks of us. The change in the political situation so suddenly brought about by the unquestioned supremacy of our ally, Japan, in the Far East is already causing some considerable uneasiness in Australia, where the universal feeling is to exclude all Japanese from their shores. The Commonwealth foresees that, sooner or later, Japan will demand from its ally facilities for, or at least the removal of obstructions against, yellow settlers in Australia—a demand which Australia will peremptorily refuse, and in that case there is sure to be trouble. The book is well worth reading, and is illustrated with a number of good photographs.

POLAR.

The Siege of the South Pole. By Hugh R. Mill, LL.D., D.Sc. With Maps, Diagrams, and other Illustrations, Preface, Appendix. Pp. 450. London: Alston Rivers, Ltd. 1905.

Dr. Mill has undertaken a somewhat formidable task in endeavouring to give us the whole history of the exploration of, or towards the South Pole, from the days of Homer to our own, in one volume. Such a book is bound to suffer from compression, and we can but congratulate the writer on having achieved his purpose so effectively. There is much to interest, and the book should form a valuable work for reference. The reader is impressed by the stupendous difficulties to be overcome in this work of exploration, and the dogged pluck and perseverance with which man after man undertook it. We British are inclined to fancy ourselves pre-eminent in these qualities, especially when the scene of the exploits is the sea, the Briton's heritage, but the most casual glance through Dr. Mill's volume reveals names from every great nation in Europe from early days, while America contributes her quota in more modern times. What a dull world we will leave to our descendants when every corner has been explored, and a journey to South Pole or North may be as cheerfully undertaken as a trip to America is now!

The illustrations are interesting, and the maps most excellent.

ANNUALS.

Whitaker's Almanack. London: Whitaker and Sons, 1906. *Price* 2*s.* 6*d. net.*

Whitaker's Peerage. London: Whitaker and Sons, 1906.

Of these useful publications it is not necessary to say more than that they come up to the usual standard of excellence. The almanack especially has won for itself a place in the esteem of all who wish a cheap and convenient reference book to subjects of current interest. The account of geographical progress during 1904-5 strikes us as wholly admirable, and is well up to date.

Wellcome's Photographic Exposure Record and Diary, 1906. *Northern Hemisphere.* Burroughs, Wellcome, and Co., London, Sydney, Cape Town.

We have received a copy of this most useful little annual for the current year. Like the preceding issues it is packed with information, and is almost indispensable to the enthusiastic photographer.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

With Flashlight and Rifle: A Record of Hunting Adventures and of Studies in Wild Life in Equatorial East Africa. By C. G. Schillings. Translated by Frederic Whyte, with an Introduction by Sir H. H. Johnston, G.C.M.G., K.C.B. Demy 8vo., 2 vols. Vol. I. pp. xxvii + 376. Vol. II. pp. viii + 406. *Price* 24*s. net.* London : Hutchison and Co., 1906.

The Africander Land. By Archibald R. Colquhoun. Medium 8vo. Pp. xvi + 438. *Price* 16*s. net.* London : John Murray, 1906.

The Chinese at Home. Adapted from the French of Émile Bard. By H. Twitchell. Demy 8vo. Pp. xii + 306. London : George Newnes, Ltd., 1906.

Life in West China, described by Two Residents in the Province of Sezchwan. By R. J. Davidson and Isaac Mason, with Introduction by Dr. Timothy Richard. Demy 8vo. Pp. xvi + 248. *Price* 3*s.* 6*d. net.* London : Headley Brothers, 1905.

The Gambia Colony and Protectorate. An Official Handbook. By Francis Bisset Archer. Demy 8vo. Pp. xx + 364. *Price* 10*s. net.* London : St. Bride's Press, Ltd.

In and Out of Chanda. Edited by the Rev. E. C. Dawson, M.A., with a Preface by the Most Rev. the Bishop of St. Andrews. 8vo. Pp. vi + 70. Edinburgh : Foreign Mission Board, E.C. of Scotland, 1906.

The Journal of John Jourdain, 1608-1617. Edited by W. Forster. Demy 8vo. Pp. lxxxii + 394. Cambridge : The Hakluyt Society, 1906.

Les Tremblements de Terre : Géographie Seismologique. Par F. de Montessus de Ballore. Avec une Préface par M. A. de Lapparent. Pp. v + 475. Paris : Librairie Armand Colin, 1906.

Also the following Reports, etc. :—

Year-Book and Record of the Royal Geographical Society, 1905. London : 1905.

The "Daily Mail" Year-Book for 1906. Edited by Percy L. Parker. Pp. xxxi + 384. *Price* 1*s.* 6*d. net.* London : Amalgamated Press, Ltd., 1906.

The Edinburgh University Calendar, 1905-6. University, Edinburgh : 1905.

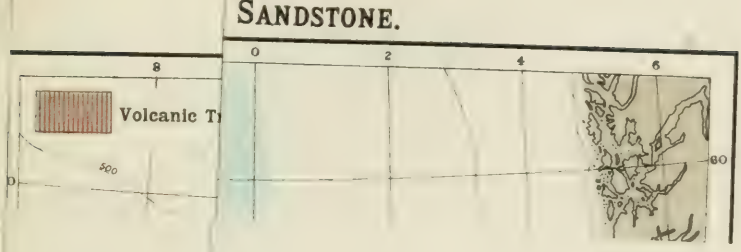
Notes on the Geology of the Continent of Africa. With an Introduction and Bibliography, compiled in the Department of the General Staff, War Office. By Alexander Knox, B.A. Pp. vi + 165. *Price* 3*s.* London : Wyman and Sons, Ltd., 1905.

Report of His Majesty's Commissioners for the International Exhibition, Saint Louis, 1904. London, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

PHYSICA

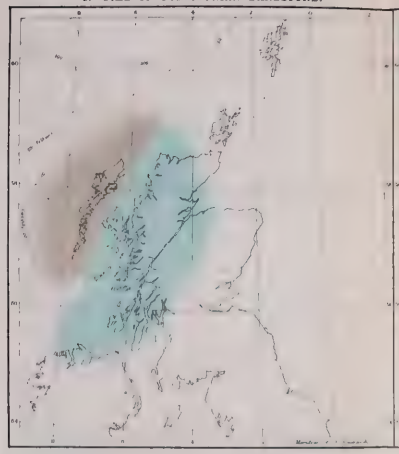
.LD GEIKIE, D.C



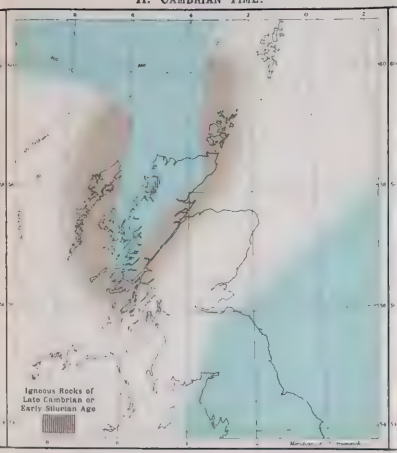
MAPS ILLUSTRATING THE PHYSICAL EVOLUTION OF SCOTLAND

BY SIR ARCHIBALD GEIKIE, D.C.L., D.Sc., LL.D., F.R.S.

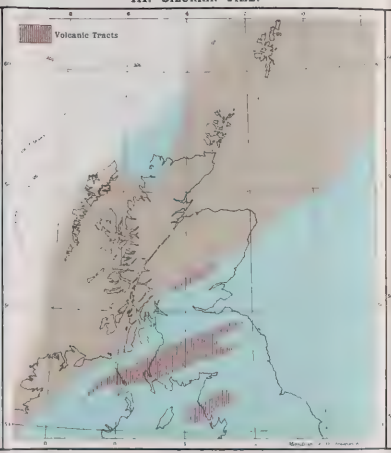
I. Time of Torridonian Sandstone.



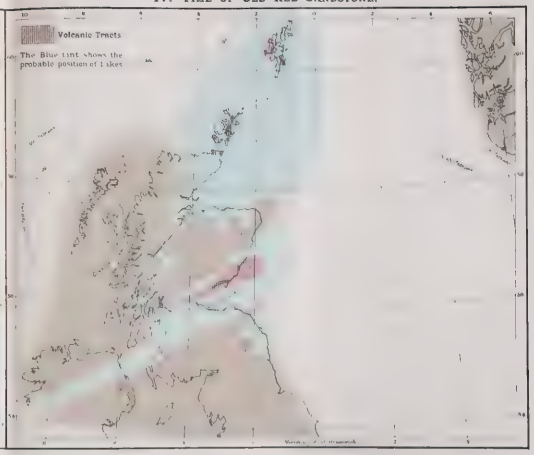
II. Cambrian Time.



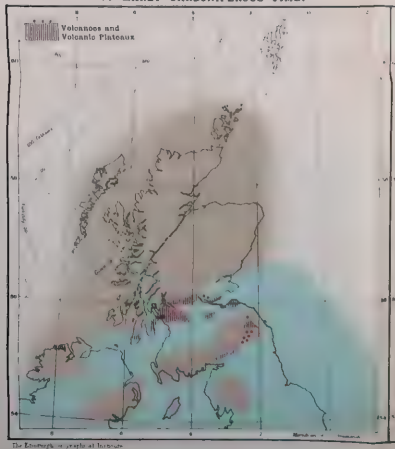
III. Silurian Time.



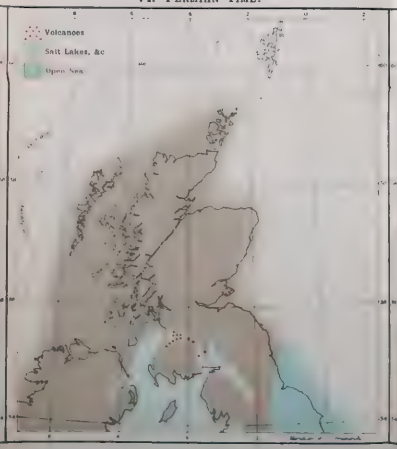
IV. Time of Old Red Sandstone.



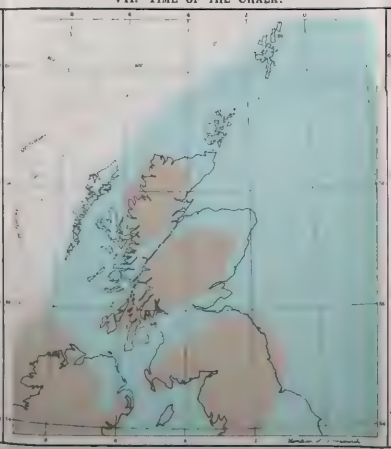
V. Early Carboniferous Time.



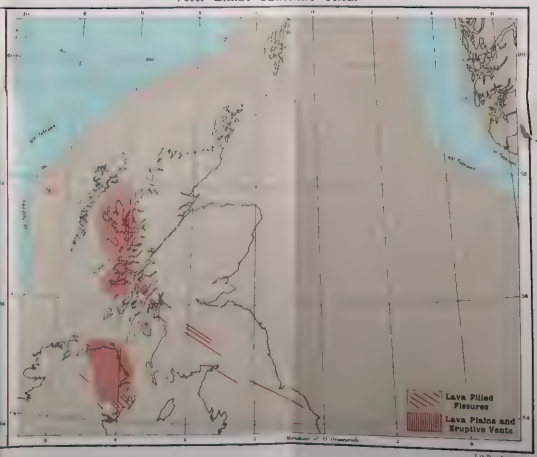
VI. Permian Time.



VII. Time of the Chalk.



VIII. Early Tertiary Time.



NOTE—In all the Maps the Land believed to have existed at the Period is tinted thus [ ] and Sea thus [ ] Regions regarding which the data are wanting are left uncoloured

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

SOUTHERN NIGERIA.

By JAMES WATT, M.A., District Commissioner in Southern Nigeria.

(With Illustrations.)

THE Protectorate of Southern Nigeria was formed in 1900, when the Niger Coast Protectorate, and that portion of the territory administered by the Royal Niger Company which lay to the south of Idah on the River Niger, were united under one administration and placed under the control of the Colonial Office.

The Protectorate is bounded upon the east by the German colony of Kamerun, upon the north by the Protectorate of Northern Nigeria, upon the west by the Colony and Protectorate of Lagos. The political and commercial interests of Southern and Northern Nigeria and Lagos are closely allied, and one step was taken in the direction of the amalgamation of the three administrations in 1904, when the offices of High Commissioner of Southern Nigeria and Governor and Commander-in-Chief of Lagos were united in the hands of Mr. (now Sir) Walter Egerton.

The estimated area of the three protectorates is 413,910 square miles, or about half that of the British territories in India. That of Southern Nigeria is 65,000 square miles, or more than half that of the British Isles.

No attempt can yet be made to form even an approximate estimate of the native population. Rough estimates give 41,000,000 as the population of the three protectorates, and 3,500,000 as that of Southern Nigeria. I think it is probable that the native population of Southern Nigeria is very largely in excess of the latter number.

Southern Nigeria is peculiarly fortunate in the number of ports which it possesses. There are nine ports on the coast-line of Nigeria. Of these that of Lagos, which is the poorest of the nine, is the only one not in Southern Nigeria. The remaining eight lie at the mouths of the Niger or of the rivers which flow through its delta into the Gulf of Guinea.

The principal port of Southern Nigeria is Forcados. Owing to the difficulties at present attending the crossing of the Lagos bar, the sea-borne trade of Lagos is taken to Forcados and there trans-shipped to branch-boats—small steamers which convey the cargo from Forcados across the bar to Lagos. Forcados is also port for Northern Nigeria, and receives a considerable portion of the trade of Southern Nigeria. Other ports are Calabar, Opobo, and Warri.

Forcados is about eighteen days' steaming from Liverpool. But it must be remembered that the voyage is interrupted by calls at various ports upon the African coast. Passenger steamers usually call at Grand Canary or Tenerife, and proceed thence to Free Town, the capital of the colony of Sierra Leone, and Monrovia, the capital of the independent

The Port of Calabar, the Capital of Southern Nigeria.

negro republic of Liberia. Soon after leaving Monrovia, the course is laid almost due east through the Gulf of Guinea. Passing the French Ivory Coast, the steamers call at Axim, Sekondi, Cape Coast Castle, and Accra on the Gold Coast. Then passing the narrow strips of German Togoland and French Dahomey, they call at Lagos roads and reach Forcados after a further run of 150 miles.

Some of the ports mentioned have a picturesque appearance. Free Town does not appear to merit its ill-omened name of the "White Man's Grave." It is well situated at the foot of the hills which give their name to the colony. Fortunately much has been done in recent years to improve the health of the Europeans, and particularly by removing their dwelling-houses from the proximity of the native town to the hills. Axim and Cape Coast Castle also have an interesting appearance. But the outline of the West African coast, upon the whole, as it

appears on the map, and as one looks at it from the deck of the steamer, is unprepossessing, and conveys no idea of the romantic history of the country and of the lives that have been spent in unveiling its secrets, in opening up its commerce, and in pacifying the savage races who inhabit it.

The River Niger flows almost due north and south through Southern Nigeria. On both sides of the main channel which issues through the Nun mouth, it finds its way by a network of creeks through many outlets into the sea. There is uninterrupted communication by means of these creeks from Lagos on the west to Eket on the east. Of the outlets the most important is the Forcados mouth, which, owing to the deep water to be obtained upon its bar, has now for several years been the principal entrance to the Niger. But the Nun branch was formerly the more important; and there is a possibility that the bar at the Nun mouth may again improve, and that at the Forcados mouth become more difficult. A similar estuary on a very much smaller scale occurs on the Cross River in the eastern part of the Protectorate.

These estuaries are the best-known parts of Southern Nigeria, and it is from them that the popular impression of the fever-haunted mangrove swamps of West Africa is derived.

The coast-line generally is low and sandy, fringed with trees. The rollers from the Atlantic break unceasingly upon the coast, and the sound carries far into the interior.

The estuaries of the rivers and the innumerable creeks which connect them are lined with mangrove-trees. These trees, with an average girth of about two feet, have numbers of stout roots raising their stems high out of the black mud of the Delta, where myriads of land crabs and "mud-skippers" (*Periophthalmus*) scurry to and fro, and an occasional crocodile is seen basking in the hot sun.

The mangrove grows only in the brackish tidal water, and, on the Niger and Cross rivers, ceases at about sixty miles from the sea. Beyond that point the main rivers flow between high banks, with small villages or trading markets at frequent intervals. The tributary streams which flow into the main rivers or their estuaries, such as the Osse, the Ossiomo, and the Adofi in the west, and the Akpa Iyefe, the Kwa, and the Calabar in the east, flow, in their upper reaches, through well-wooded country; and many of the valuable forest trees whose timbers are to an increasing extent coming into the market are found on or near their banks.

It will be observed that between the River Benin upon the west and the River Opobo upon the east, for a considerable distance inland, few names of towns appear, and, in fact, the settled population in this part is very small. Such native villages as there are lie upon the banks of the rivers and creeks. The inhabitants are a waterside people, engaged as middlemen in conveying the produce collected by the dwellers in the interior. The country is a vast network of creeks, with patches of solid ground here and there where a solitary fisherman builds a little hut to watch his fish-traps, conveying his catch from time to time to the nearest market, or to some settlement where the fish are sun-dried and fastened upon wooden skewers for sale in the up-country markets.

Beyond this network of creeks a region of solid ground begins, densely populated, as appears from the map. This is perhaps the most fertile portion of the Protectorate, is rich in palm-trees, and for the most part under cultivation. No system of rotation of crops is practised; it is left to nature itself to restore the elements which are required for future crops. A piece of land which has been farmed this year will be allowed to lie fallow for the five or six following years. So quickly is the soil overgrown with luxuriant vegetation that it is often not without difficulty that one finds one's way after the interval of a year. The whole aspect of the country seems changed, and there are few objects to serve as landmarks. As one advances north more undulating ground appears, and when the rolling hills are crowned with villages, as is frequently the case, the large trees which are usually found in their vicinity add picturesqueness to the landscape, and it is possible, from some hill higher than the rest, to get a wide prospect over a distance as great as thirty miles.

The Delta may be said to end, and the true African continent to begin, at Onitsha on the River Niger and Ungwana on the Cross River. At these points a rocky formation is first met, and inland from the rivers are rocky hills attaining a much greater height than the low rolling hills of the Delta.

Possibly the most interesting part of the country to the geologist lies in the extreme east near the German colony of Kamerun.

On a clear morning in the early or late rainy season, as one rounds the bend of the Calabar River into the estuary of the Cross River, one sees the whole mouth of the river blocked by the giant peak of Kamerun, and the whole eastern horizon filled with peak after peak of clearly defined mountains. Four rivers issue from this mountain region and break their way over falls of about thirty feet in height. The formation consists of crystalline rocks, granites, gneiss, and the like, and no minerals of great commercial value have as yet been discovered. A deposit of tin has been found upon the Calabar River. It has not, however, as yet been examined with any completeness. The mountainous region is thinly populated, and densely forested with ebony, mahogany, and other valuable timbers. Here the elephant wanders, and it is to be hoped that the protection now provided by the game-laws will preserve it for many years. No more interesting natives are to be met than the hunters who face many dangers in the laborious pursuit of their game; but it is very necessary that restrictions should be put upon the indiscriminate killing of wild animals.

The mountain region now described is an isolated feature peculiar to the eastern part of the Protectorate. To the west of the Cross River no similar formation occurs. The rocky hills which extend from the Cross River to the Niger and thence to the Lagos boundary are sedimentary in their formation.

The Customs Report for 1904 shows imports of the value of £1,792,468: exports of the value of £1,718,717. Of the imports, Great Britain sent goods to the value of £1,416,554, and of the exports received produce to the value of £1,079,544. British vessels conveyed

imports of the value of £1,651,447 and exports of the value of £1,509,190.

The following table shows the value of the principal exports during 1904:—

Palm-oil	£710,055
Palm-kernels	597,953
Rubber	158,990
Timber (including ebony)	60,312
Ivory	3,468
Cotton	2,501
Cocoa	4,981

All these products, with the exception of ivory, show a steady increase in the four years ending 1904.

It appears from the table that the oil-palm is the principal source of wealth: timber is already a considerable industry and is likely to increase still farther in importance: the value of the cotton exported must be taken to indicate only that cotton of that value, and possibly of a very much larger value, can be produced. The industry is as yet only in its experimental stage.

The oil-palm is found in profusion in all parts of the Protectorate. The palm-nuts grow in thick clusters of two or three feet in length, and are of a bright scarlet colour when ready to be picked. When the nuts are ripe the clusters are cut and left upon the ground for some days, until the nuts are loosened in their cups. The nuts are then taken out and boiled until the oil from the fleshy outer covering is extracted: it is then reboiled and skimmed, and when it has been thus refined has a clear deep claret colour. Palm-oil, produced in the Niger towns by a somewhat different process, is thicker and yellow in colour.

The palm-nuts, after yielding the oil from their outer covering, are cracked in order to obtain the kernels which form a valuable article of trade: they are exported to England or Germany and manufactured into oil. The cracking of the nuts is a laborious process, and, as yet, the primitive method of cracking each nut separately between two stones is that almost universally followed by the natives. No machine as yet devised has been entirely successful in separating the kernels from the shells. In proportion to the oil produced a much larger quantity of kernels should find its way into the market. Doubtless as time goes on less wasteful methods of producing both oil and kernels will be devised.

In the Delta, where the finest oil is produced, the oil and kernel trade is almost entirely in the hands of the rich native middlemen, who collect the produce in small quantities in the up-country markets, refine it, and bring it down in their canoes to the factories, as the local agencies of the British firms trading upon the West Coast are called. In the old days, when might was right, a big trader might bring down as much as a hundred puncheons of oil, of the value of about £12 each, in one season. But the up-country people are learning every year the advantages of trading direct with the European factory; for there is no

end to the trickery of the native middlemen, as the European merchants have often found to their cost.

The oil-markets frequented by the native middlemen are usually situated on small creeks, where the native traders build their sheds. The natives from the interior come down in large numbers to these markets, bringing their oil and kernels in exchange for the trade goods brought up by the middlemen. The market-places are either in the centre of the little market towns or on a main path in the bush. They are busy, noisy places: the women, who do most of the petty trading, are ready to run at a moment's notice. It is not many years since there was real danger for a woman travelling to distant markets, but now kidnapping, murder, and robbery, though not unknown, are comparatively infrequent, and the women walk twenty or thirty miles to market with their baskets on their heads containing kernels or pots of palm-oil.

The European factories or trading-stations upon the banks of the rivers have grown up within the last thirty or forty years. Formerly business was transacted upon the hulks of old trading-vessels moored in the rivers. When trade was first established the practice was for the ships to load up at home with such trade goods as seemed most suitable; and remarkable collections these cargoes must have been, of old hats, uniforms and helmets, cannon and cotton-goods, powder and gin, which then, as now, formed a considerable item of the trade. The ship then went round the various trading towns at which it was proposed to call, and the supercargo made arrangements with the native traders to collect oil and kernels for him, giving them goods on credit or "trust," to use the expression current upon the Coast. When the vessel had made the circuit it would be time for her to return to her first port of call in order to pick up the produce collected. Often enough the supercargo had great difficulty in collecting the full value of his "trust," but the profits in these golden days were very great. Alas! the climate played havoc with the crews. The West Coast of Africa had in those days a terrible reputation: the traditions of the rough lives of the adventurers, who began the trade of West Africa three hundred years ago by conveying slaves to the West Indies and America, long survived, when to the perils of the climate were added those of a consumption of spirits which would have tried any but a constitution of iron. West Africa is not likely ever to be a healthy place of residence, but the conditions of life have improved enormously, and, though invaliding is frequent, it often saves lives and must not be taken to mean that the constitution is ruined.

The oil-trade was the staple trade which took the place of the slave-trade. It is true, no doubt, that slavery was a punishment inflicted upon criminals by the natives, and many of those shipped to the West Indies were men who left their country for their country's good. Even if none others had been shipped, the slave-trade would have left an indelible stain upon the reputation of the civilised nations who took part in it, but it would not in that case have produced the disastrous results which flowed from the state of inter-tribal war which it induced: a war which had no elements of romance, which was waged

upon women and children, and which contributed very largely to that state of terror in which the natives of the interior still live.

Of the other exports referred to in the list given upon p. 177, rubber and timber deserve special mention. The Government has assumed the charge of the forests. A forestry department has been established, the officers of which see that the forest rules are observed, that only trees of sufficient maturity are cut, and that seedlings are planted and maintained in place of each tree cut down. Rubber-collecting remains in the hands of the native traders, who are obliged to comply with the rules made for the preservation of the rubber vines and trees. The royalties collected from the holders of timber concessions and the rubber-collectors are divided between the Government and the native owners of the forests.

The Government is engaged in establishing nurseries and plantations of rubber in the principal villages, and the natives are beginning to take an intelligent interest in an industry which promises much prosperity to the country.

The British Cotton-Growing Association has established two experimental farms in Southern Nigeria, at Onitsha in the Central division, and Ugboha in the Western division. On these experiments are being tried with a view to ascertaining the most suitable species and the best season of the year for planting. It is not anticipated that European-conducted cotton plantations will ever be commercially successful, but the hope is entertained that the planting of cotton may be extensively taken up by the natives themselves, who already plant for their own use native cotton of a good variety. Efforts have been made with considerable success by the Government to get the chiefs of the various towns to clear a few acres of land and to plant them with selected seed under adequate supervision. These are intended to provide object lessons, from which the people may learn the advantages of the trade in cotton and the best methods of cultivation.

The Government has under serious consideration the improvement of transport throughout the Protectorate. Much has been done to improve communication by clearing waterways which were impeded by vegetation. Facilities are now offered to the natives for transport by Government launches on the Niger and Cross rivers. Roads are being constructed which will be available for wheel traffic, and the native paths are being straightened and improved. The question of railway development is under consideration, and surveys are being undertaken with a view to ascertaining the routes which are most practicable and best calculated to open up trade throughout the Protectorate: the larger question of railway policy for the whole of Nigeria is engaging the attention of the Colonial Office, and is the more important in view of the enterprise of the French, who are constructing a line from Dahomey to Say on the Niger, and of the Germans, who have now made arrangements for the construction of a railway in Kamerun.

It would be impossible within the limits of this paper to give an account of the native races of Southern Nigeria. The Protectorate differs from the other British possessions in West Africa in being

inhabited by a great variety of tribes. It seems as if the stronger races of the interior had pushed down into the Delta the inferior races which preceded them, and this process was apparently still going on within the brief time covered by native tradition. In general, the lowest races are to be found nearest the seaboard of the Protectorate.

Of the great native states of West Africa, Benin alone is in Southern Nigeria. The Portuguese were the first Europeans to come into relation with Benin, and *Hakluyt's Voyages* contain several vivid narratives of early visits made to the city by English sailors and merchants. The recollection of the horrors discovered by the Punitive Expedition which took place in 1897, a few weeks after the massacre, is still fresh. But this recollection ought not to obscure the recognition of the

Native Dance, Calabar.

comparatively advanced culture to which the Binis had attained. The Benin work in bronze and ivory far surpasses any similar work in Southern Nigeria, and the collections in the British Museum and the Royal Scottish Museum in Edinburgh are well worth inspection. The Binis are an intelligent race; they have dances and songs far superior in grace and melody to the uncouth and often indecent contortions and dreary monotony of those of other tribes. They have shown also greater appreciation of the methods of administration, for, under the rule of the old "king," an organised executive existed.

In the administration under the British Protectorate the authority of the native chiefs is maintained as far as possible. The country is divided into districts, and, under the commissioner in each district, are native councils, upon which the chiefs sit. Criminal and civil cases between natives are tried before these councils, and the fees and fines

collected are expended upon the maintenance of the councils and upon measures for the improvement of sanitation, roads, and bridges.

The development of the country is slow, for the natives are conservative of their old superstitions and ideas; but, with the progress of sound education and the material changes which are taking place, much more may be expected.

A large number of Government schools have already been opened, and a system of Government inspection has been inaugurated in those mission schools which are in receipt of grants.

The principal missions in the East are the United Free Church, the Primitive Methodist, and the Irish Presbyterian; in the West the Church Missionary Society and the Roman Catholic.

No statistics afford a measure of the results of the work of good missionaries; but the work of Great Britain in Africa would be incomplete if it were not for the intimate influence of their upright and self-devoted lives.

See *Stanford's Map of Southern Nigeria*: 1905.
Colonial Report No. 459, *Southern Nigeria*: 1904.

HANOI AND KWANG-CHOW-WAN: FRANCE'S LAST ACQUISITION IN CHINA.

By Mrs. Archibald Little.

Hanoi is so prettily and brightly laid out, that I shall always think of it as of a patchwork of green sward picked out with ornamental shrubs and statues by the side of coquettish lakes with many reflections.

There are, of course, grotesquely over-decorated Annamite temples, as well as the picturesque watch-tower, sole remnant of the old Palace; there is an Annamite quarter full of women with enormous hats, a big black tassel hanging down on either side, and for the rest, dressed in a symphony of shades of brown, the material of which their long tunics are made being of a lighter colour in the inside, so that when they girdle themselves with a bit of it they at once get two shades, often adding a dash of deep orange. The becoming cut of this easy-fitting long tunic; the distinguished carriage of the women, owing to their always having to balance their enormous hats upon their heads, and often carrying heavy weights upon them again; the freedom with which they step out, and their elastic tread, make it an immense pleasure to see them after the cramped, sickly, ill-developed women of China. If only both men and women would not blacken their teeth they would be a singularly good-looking population. As it is, they are always laughing or smiling, and thus displaying what appear like toothless gums, owing to this practice of blackening.

The town seems to centre round the very pretty Petit Lac, with its border of gardens, well laid out all round it, a mock ruin of a Paifang, or memorial arch, on a little island in the middle, and a pretty old Annamite pavilion on another island on the far end, beside a real old Annamite temple. To this last there is a very picturesque entrance. Adjoining there are two admirably laid-out square gardens, in one of which the band plays in front of the very comfortable-looking Club; and from the further square a very few steps down a shady boulevard take you to the boulevards by the Red River, where the new Military Club is being built with a reckless prodigality of wide verandas all round. There also a theatre is being built, both buildings at the entrance of the very shady Avenue, across which the Flamboyantes or Ponciana interlace their feathery foliage, and which still goes by the name of the Old Concession. The Governor's house is there, and the General's and the État Major's, all with sentries guarding. The Crotons with their many-coloured leaves growing up the trunks of the trees in the Governor's gardens, were particularly fine. At the far end of the Avenue were the soldiers' quarters, and the Hospital, which, as the gatekeeper informed me, is a great deal larger than it looks, having a block for natives, and a block for civilians, as well as the part reserved for the Army. It did not appear to me a place to get well in, nor did the soldiers' quarters look healthy; but perhaps it is a mistake to think it unhealthy to have trees pressing round the windows, shutting off the air. They must also shut out the sun, of course. But though the sun is a terrible enemy in the Tropics, I always believe the Naples saying, "Where the sun does not come in the fever does"; also I distrust the influence of vegetation, and am a great believer in the purifying influences of air in motion. It is this that makes the Yunnan Uplands so delightful, whilst it is the want of motion in the air which makes our own Province of Szechuan so depressing.

What I specially admired in Hanoi, however, was the excellence of the roads—this seems to be a strong point with the French—and the goodness of the rickshas, although every one who lives there seems to keep a carriage. Everything shows that Hanoi has not just been allowed to grow fortuitously, as seems generally the case with our English places, but has been laid out with a definite plan, and with the deliberate intention of making it as pleasant a place of residence as possible. The fashionable drive is very pleasant. As to the Botanical Gardens, I was fairly charmed with them, not from the attention there shown to Botany —that indeed seemed deficient, even the names of the plants being generally wanting, but that, like every other blemish, was said to be the result of the late terrible typhoon—but because the gardens are so pleasantly laid out, and contain so many animals, all, as it appeared, in the perfection of health. Anything more graceful than the long-armed gibbon, as it sprang about its cage, it would be hard to imagine, whilst the elephant was particularly sensible in the way it took ten cent. pieces with its trunk to buy bananas, though, like other people, we were puzzled when no bananas seemed forthcoming for the sensible, big creature. Besides all these animals, there is a special corner arranged for the delight

of children, with swings, a donkey, a Punch and Judy show, etc. Where in English resorts do we find any arrangement of this kind, the want of which often leaves children dull, besides making them a general nuisance?

The principal building of the late exhibition is being transformed into a museum under the Office of Agriculture and Commerce, but that is hardly done yet, and the site has only lately been bought for a museum to hold the ethnological collection now crammed into three villas. It is to be hoped this may be well attended to, as the diversity of races in Indo-China is so interesting. Already for some years a most useful institution has been in full working order, that is the Haras, where M. Lepinte, whose family have been breeders for two centuries, is trying not only to develop a good breed of ponies by introducing Australian horses, Tientsin ponies, etc., but is also mixing French sheep of various kinds with those from the Yunnan Plateau, and with English Southdowns, and breeding geese, ducks, chickens, Numidian hens, together with an immense quantity of pigs. What with the German scientific experiments in forestry at Tsingtao, and the French scientific experiments in breeding at Hanoi, we must surely all soon learn a good deal. I was especially interested to see the very thorny plant of which the hedges are formed, and which I had always looked upon as quite useless, being chopped very fine as food for ponies; as also to learn that one acre at Hanoi will produce ten tons of hay, whereas in France it produces only two. There are races every Sunday during the winter at Hanoi, so that every attention must be being paid to racing stables.

The elegance of the Hotel Metropôle, furnished in the ancient style, and with small-paned windows and imitation Gobelin tapestry on the walls, showed how far taste there is advanced beyond that of Hong Kong or Shanghai. Owing to the—as I think—uncomfortable habit of shutting up shops and offices and everything from 11 to 2, I could not judge of the taste in the shops. There seemed to be many large ones. But I was sorry to see the shop people still busy in them as the daylight faded, for it seemed as if it would only be on Sundays they could get any fresh air or exercise. I did not see any one playing lawn tennis or any sort of game at Hanoi. Even at poor inundated Yenbai there was a most animated lawn tennis going on whilst we were there, the gayer perhaps that it seemed it had to be all over in half an hour, the darkness coming on so quickly as the evening grew cooler.

The new Governor's house does not look as if it would be an ornament. Somebody seems to have designed a fine plan for it, and then some one else cut it down. The result is a heavy, big building near the Botanic Gardens, and the few relics of the past, principal amongst them the picturesque Watch Tower of the old Palace. The temple of the Big Buddha is another of the sights of Hanoi. The bronze statue is said to be the largest in the Colony, but it was so dark when we saw it—it generally is too dark when one sees things in the tropics—I had to take it on trust, all but one foot, which did not appear finely modelled. There was, however, some fine decoration about the entrance. We could not think what all the children were calling out there, when

they had at last finished their "Bon jour, Monsieur et Madame," it was, however, "Vive Loubet," and they shouted it with an extraordinary animation.

The Annamite quarter with its shops was the more amusing because the children's festival came off whilst we were in Hanoi, and the Dragon Festival was just coming on, so there were shops and shops full of toys in the most brilliant, elementary colours, as also of huge fishes and crabs, and other peculiar creatures formed into lanterns. I disliked the Annamite embroidery as much as it is possible to dislike such careful handiwork, the colours, especially the pinks and purples, being more trying than even in the newest Hongkew embroideries in China. Some of the large pieces done in soft colours would of course furnish rooms richly, but they all looked purely mechanical. I did not like the inlaid enamels much better. They may have been very pretty originally, when they were all of flowers and butterflies and grasses; now, to suit France's taste, and possibly in the first instance the taste of the French soldiers, men and houses are reproduced in huge pieces of enamel, neither in themselves beautiful, nor, as thus used, forming a pleasing picture. Even as originally made for Annamites, there is an unrest about the many varying hues the mother-of-pearl takes that is unpleasant. The inlaid copper is much better, though that too has been degraded by the reproduction of large basins with clumsy European jugs. There are, however, still little bits of fine workmanship to be found. The worked silver, on the other hand, is equal to, if not better than, that of Japan. It is all oxidised and very beautifully worked. Its great drawback seemed to be its excessive weight. A pot, after all, is meant to pour tea from; one does not want for that purpose a beautiful object, which one can barely lift when empty. Nor does a lady care for a parasol handle that weighs her down. But when this little difficulty is got over, the work is excellent, and the result beautiful. It was curious that I did not see a single brush-back or button-hook—articles that always so abound, when the buyers are expected to be Anglo-Saxons. French people, I should gather from the Hanoi shops, are still buying embroidered table-cloths and cushions—the latter with bunches of enormous flowers—against which to rest their backs. There Hong Kong seems decidedly more artistic.

Nothing could be much less interesting than the flat railway journey between Hanoi and Haiphong, if it were not that, just before arriving at the latter place, one sights a reef of exceedingly hard limestone rocks, looking like the tops of a mountain range projecting out of the rice-fields, just as, a little further, they emerge from the sea, forming the great feature of the celebrated Baie d'Along, which we greatly regretted not visiting. Unfortunately, it is not arranged as a tourist trip; indeed, nothing seems to be in Tonking, which decidedly does not lay itself out for travellers. One has to take passsage by a cargo boat somewhere or other, thence hire a small boat to see the various lochs and islands—once the resort of pirates—and then wait patiently till the cargo boat returns to bring one back. Thus one may, with luck, do it quickly, or one may take five or six days over seeing it. It must be a singularly

beautiful sight when the sea is a deep, deep blue, as some people report it. But this could not be the case in the season of typhoons, which was unusually prolonged that year.

Of Haiphong we saw but little. We were taken for the fashionable drive, but as usual too much in the dark to see more than that there was a great deal of water about. That seems to be the feature of Haiphong, the quantity of water, till one wonders there are not canals and gondolas. It is again prettily laid out, the sparkling green grass, and number of avenues of trees beautifying both it and Hanoi, and there are many fine houses, but Haiphong is not coquettish, and is too much spread out. This is said to be the fault of M. Marty, who owns much property in the middle of it, and will not sell.

The principal hotel is a fine building well situated, but, even after Chinese inns, some of the arrangements struck me as very *un*nice. This, however, was but a breaking in for the Marty boat *Hué*, by which we left, and which certainly was the very dirtiest, most evil-smelling boat I had ever travelled by. The steamer has been a very fine one, by good English makers—one of the best, probably, that ever came out to China ; but it has been so neglected that water came into the cabins everywhere, so that it was as impossible to keep one's things dry as to keep the smells out.

We called in at Pakhoi, with an *immense* fleet of fishing boats, a projecting treeless headland, and a breezy flat shore behind the Chinese town, where the little foreign community seemed all exceedingly pleased with one another—their riding, which they boasted was the best in China ; their quarters, which they said were among the best ; and their tiger hunt, although it seemed, so far, the tigers had had the best of that.

Then we lay off Hoihow, at a great distance, for a whole day, a mail boat at last managing to come off to us, and later still to bring back the mail to us. Torrents of rain swept across occasionally, and the wind blew so that our landing was out of the question. Next day we started at daybreak, and by five o'clock found ourselves moored within the wide bay of Kwang-chow-wan, the last French acquisition in China. We lay at about equal distances from Matchie, where the French have built a little town for the administration of the colony, and Fort Bayard, where the soldiers are quartered. Some way up a creek to the right as we entered, we had seen two French men-of-war moored off the naval station that must be at least two miles from Matchie, and which it is now decided to abandon. The idea of building three brand-new towns all at inconvenient distances from one another, seems so absurd one can hardly credit it till one sees it. There is something particularly distasteful about Matchie, where we landed the first evening. One understands a new town of rough shanties, people in working dress going ahead cheerily in a rough-and-ready fashion. But this poor four-year-old has got a few elegant villas, mansions even in some cases, also a great many so-called avenues, laid out and numbered. I do not think there is any avenue without any house in it, but one or two is the usual number, whilst the avenues are wide, and the trees beside them so small as to be hardly noticeable. Then, to make it worse, the typhoon of August 10th

had knocked the landing-stages about, blown the roofs off the houses; the Residence had had to be thatched for the time being, the market's roof was only then being repaired, and most of the other houses had been injured, whilst palings had been blown down on all sides, and several of the avenues were so swampy one could hardly get along them. We saw a gentleman and lady quite smartly dressed going round looking at the various houses. Travaux Publiques we supposed they belonged to. We saw a little child being led along on a pony. Nowhere else was there any one except at a rather miserable-looking shanty, that proved to be a post-office. There there was a little group of men, who obligingly pointed out to us the house of the Annamite Guard, with a big prison behind it. "Oh, it is a great thing to have a prison in which to shut up evil-doers," they said, but whether in seriousness or in self-mockery, of which the French are so fond, I do not know. It poured all night, it poured next morning, but we had thought it prudent to secure the boat that brought us off the night before to take us on shore the next day, and there was its ochre-coloured mat sail bobbing against the side of the steamer, so we decided to risk the weather and go to see Fort Bayard, the military town separated by about a mile of water from the Government centre Matchie. Taken as a town, Fort Bayard was certainly very much better than Matchie. Taken as a military depôt, it was really very good. There was a little row of Chinese shops as we landed, then quite a well-supplied French shop, presided over by the one man in the place not an official, and who had come up with us in the steamer and greatly entertained the company by his animated controversy with a young member of the administration, who of course lived at Matchie, as to the relative merits of the two places. Whenever hard pressed, the latter always returned to the Jardin Botanique at Matchie. There is none at Fort Bayard, whilst in that at Matchie there is actually already one monkey—a beginning! as the young official said. All the fellow-travellers now met in the one shop, and as people always do when they come from a metropolis like Hanoi, proceeded at once to buy furiously. We heard that our captain had already sent on shore for a bottle of absinthe, the *négociant* having good-naturedly undone one of his cases on the voyage, that his compatriots might not be deprived of this necessity. We hoped he might at the same time have sent for matches, the well-supplied passengers having so far had to give them to those less well-provided, also to the servants when it came to a question of lighting lamps, there being apparently no matches supplied by the Marty Company. Our friend now treated us each to a biscuit, that also being a luxury unprocurable on the steamer.

We then went on to see the Cathedral, a great credit to the French Father who had designed it, being very well proportioned, light and elegant, and admirably adapted to the climate, with its tiled floor, plain wooden benches with just a few basket chairs in front for the notabilities, and Gothic windows filled, not with glass, but with close plaster openwork, thus shutting out the rain, whilst giving free passage to the air. The typhoon enabled us to see that the wall round it,

which appeared to be built of very neat red bricks, was merely earth so coloured with lines drawn upon it to represent bricks. A house near by was completely in ruins. But the houses of the various officers had stood well, except for their roofs. Many of them were very pretty buildings, and being all grouped together, the roads, though naturally on such a day very wet, looked quite sufficiently furnished, and had none of the dishevelled appearance of Matchie. A young officer kindly took us over the quarters of the Colonial Regiment; these seemed quite comfortable and very clean. Those of the Artillery were not quite so clean; those of the Annamite Regiment very clean indeed, but naturally rougher and more crowded. There was a fine-looking airy hospital beyond these quarters. We were taken to see the Officers' Club —the one building presented by M. Doumer, the late Governor—all the rest having been paid for by the military. It is a fine building, most conveniently situated as a point of reunion by the seaside, with reading-room and restaurant. The latter has been really beautifully decorated with designs in black and white by a veterinary surgeon, who must be a true artist. His reproductions of figure pieces, extending over a whole wall sometimes, as also of landscapes, were both very good; but what he seemed particularly to excel in was his treatment of leaves and branches, with which he had decorated all the rest of the wall space. His artistic work must add immensely to the enjoyment of those who congregate at the restaurant, and who would feel very differently drinking their coffee among bare walls. We had before that passed by the Sergeants' Club, and had been told how the men amused themselves getting up theatrical representations. They must need something to entertain themselves, for, fine though the bay is, I have seldom visited a duller-looking place than Kwang Chow.

I was told there were three ladies there, and saw two of these during our short stay. There are said to be ten married officials at Matchie; no one we spoke with but seemed to advocate the union of the three towns. The naval men were said to have settled to join the military, and the time of our visit would seem decidedly the moment for the civil officials to come over too, before they had gone to the not inconsiderable expense of re-roofing and repairing their houses. They might even bring their bricks and building material with them, so as to avoid the spectre of an official mistake on the other side of the water, such as at Laokoi, where some one began to build a bridge across the Red River without counting the cost, so that the enterprise has had to be abandoned, the pieces still standing in the river, a memorandum in stone of the mistake made by somebody.

No one can visit Yunnan without hoping heartily that no such fate may befall the daring French enterprise of building a railway up on to the tableland. It will not only greatly benefit the dwellers in Tonking, but all the world, drawing into communication with it one of the most delightful regions in Asia, the bird- and flower-full Uplands of Yunnan. In another three years this railway should be completed. But it is a difficult undertaking, which will reflect great credit upon the French when they have completed it; engineers say quite as difficult as the rail-

way on from Tashio by the Kunlong Ferry to Talifu, for which, so far, the British Government seems to lack the energy, although our territory marches with the Chinese Province of Yunnan quite as far as does that of the more enterprising French. Whoever builds a railway into Yunnan confers an immense benefit upon that as yet poverty-stricken province, and possibly a scarcely less benefit upon the world. For, besides birds and flowers and fruits and health-giving properties, all Yunnan has great mineral wealth so far undeveloped.

SOME NOTES ON THE AINU.

By Jessie Ackermann, F.R.S.G.S.

(*With Illustrations.*)

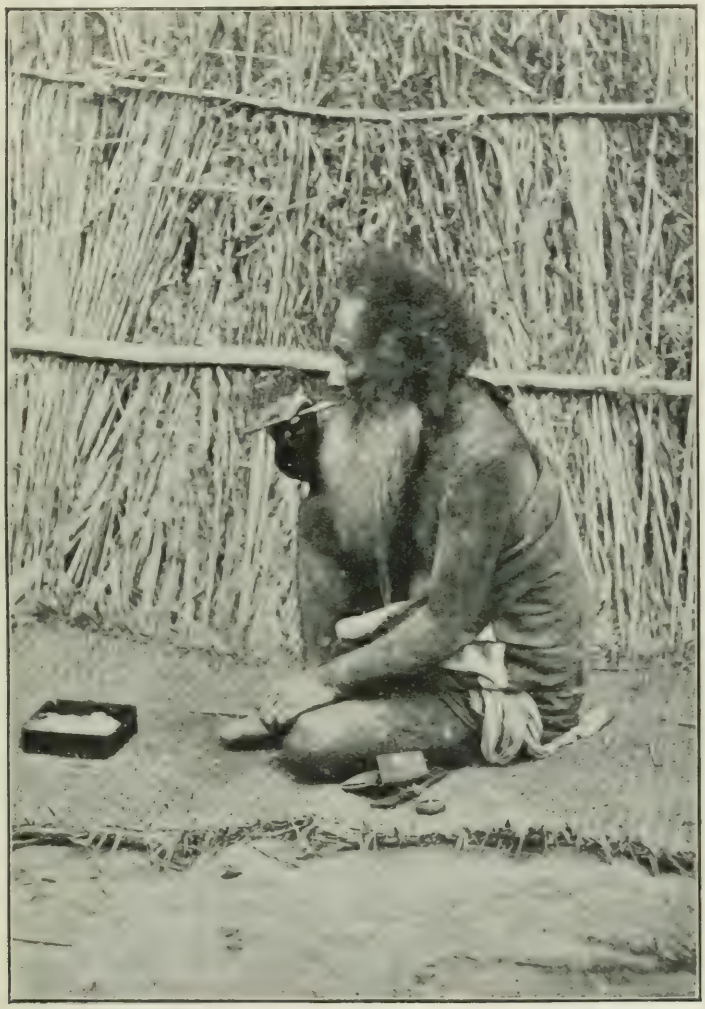
Various theories have been advanced from time to time as to the origin of the Ainu of Japan, and the manner in which they reached that island. One of the latest is that they are the descendants of the cave-dwellers of Southern Europe. It is thought, surrounded as they were in Southern Europe by stronger and more numerous races, the cave-dwellers were gradually driven across the entire continent, finally landing on the remote Island of Japan, in the history of which country (dating back to 712) may be read an account of these people. It is said that when the "Son of Heaven" took up his abode on the island, and made his way across the country, he encountered many barbarous tribes, chief among them being the only surviving race, the present Ainu. As the Japanese increased, the "savages" were all exterminated save these.

In the struggle for supremacy the Japanese were victorious, and these ancient possessors of the land were evidently put to flight; seeking refuge on the sterile islands of the north, the greater number are now found in Yezo, a few in Saghalien, and a small colony in the Kuril Islands, in all of which places I tried to gain some knowledge of their own ideas of their origin, but they have not so much as a tradition concerning themselves.

The chief guide to investigation concerning native races is found in the character of the hair and the shape of the skull. Judging from these points there is every evidence that the Ainu are not of Asiatic origin, but have come along some lost European line. In build, feature, form, tradition and custom, there is no suggestion that they are of Asiatic origin.

Certainly their faces could hardly be less like the Japanese, and their complexion is anything but yellow: in fact, if tinged at all, it is rather of the brown tones than the yellow. Their flesh is massed over a heavy framework, and in their prime they are powerful. Then, too, the characteristic feature of the men is the strikingly absent one of the average Asiatic—the Chinese, Koreans, and Japanese produce but a sparse growth of hair, whereas the Ainu men are almost disfigured by

an entire covering of coarse black hair, which reaches great length upon the head and face in old age. It is said that primitive man was much more hairy than his descendants of to-day, and in this respect the Ainu suggests a likeness to him, for the whole body is covered with a coat in many cases as heavy as that of a monkey. This is considered a



Ainu man, showing hair on body.

mark of great distinction, indicating "pure blood," a matter in which they take no small degree of pride. The women are singularly free from this savagelike feature. They have open, frank faces, and would be good-looking were they not in youth branded with the badge of the

tribe; and so ancient is the custom that, like foot-binding in China, the meaning and origin is completely lost in the shadowy centuries through which it has been handed down, without other reason than "our ancestors always did it."

When a girl is born and enters upon the second year of her troubles, the devoted Ainu mother proceeds to stamp the indelible crest—so to speak—of the tribe upon her helpless offspring, for the girl can never hope to win a husband among her kind until she has a full-fledged moustache tattooed upon her upper lip, and as if to make doubly sure her chances of so desired an end, the outline is continued to the centre of the chin and well toward the ears, ending in a diamond-shaped point on either cheek.

As this operation is very painful, it is done a little at a time, two years usually passing before the torture upon the little creature is complete. A concoction of roots, leaves, and bark is brewed, and when ready for use, a small fire of birch-bark is kindled under an iron pot, to which clings a heavy coat of soot. A goodly portion of this is rubbed over the surface of the skin before the liquid preparation is applied, and, prick by prick, the instrument of torture "sets" the colour deep under the skin, beyond any possibility of removal. The work is continued from time to time as the irritation caused by the scratching passes away. During the growth of the child this blotch increases until it becomes the disfiguring feature of every woman.

In olden times it was the custom to continue the work of decoration after marriage by tattooing a band across the forehead, rings on the fingers, and many circles far up the arms. This seems to have passed away, for I noticed it only among the old women. In spite of all, however, there is a strange fascination about Ainu women. I felt irresistibly drawn toward them; and although it has been shown that they have but limited brain-power, they are quite lovable in many of their pretty ways.

It is quite true that they share the fate of all women of the East, in that they are considered far from being the equal of men, although they do the heavy work and are the chief factor in their industrial world—such as it is! Of course the men cheerfully aid by free advice and full direction, but as to real toil—they pass it over bodily to the women, who, with great deference to their lords, enter upon any given task, and at odd times vie with each other in the pleasant pastime of "dressing up" their husbands, each striving for the most becoming results.

When married, an Ainu woman is not even honoured with her husband's name, but is still called by the name of her own mother, or the wife of so-and-so. If widowed, she takes the name of her child if she has one, which is usually the case, it being considered an endless disgrace for a married couple not to have a family. This, indeed, forms sufficient grounds for a man to divorce his wife. In such a case it is supposed that the gods are punishing *the woman* for some of her evil deeds, and without a chance to defend herself she is declared divorced; there being no higher court of appeal than the will of her husband.

The women spend their spare time decorating festival garments for

their husbands—a garb fearfully and wonderfully made; but although perfectly grotesque when taken apart from the wearer, it well becomes their unique style.

The cloth is hand-woven from the fibre of the elm-tree, and coloured with a dye produced by boiling green indigo leaves, a preparation found in every house. The kimono-like dress is made of ugly, dirty-looking blue cotton, upon which patterns in light colours of all things seen and unseen, known and unknown, are neatly sewed. These stand out in bold

Ainu women weaving.

relief against the background, rendering the wearer visible for the entire sweep of vision.

When a man receives the finishing touch from the hands of his wife, and stands fully arrayed in glory for a bear-feast, his head crowned with a bewildering halo of pine shavings, which mingle freely with his unkempt locks, he is truly something to look upon.

But a fond wife's duty does not end here. The long-suffering woman scours the region round about to find any kind of a horse upon which her lord may ride to the village. I have seen an Ainu woman assist her husband to mount, and as he rode off in state, she splashed through the mud ankle-deep trying to keep pace with him.

The Ainu style of building doubtless indicates much as to their former locality if it could but be traced back. Strangely out of keeping with the severe cold of the North is the straw roof peeping out of the great snow-drifts, and the lack of protection from the biting blasts fills one with wonder that they have not all perished long ago; yet rarely can one be found ready to make any change in the long-established mode of building.

When a farmer makes up his mind to depart in the smallest degree from the established style, he makes a feast, invites the headmen of the village to attend, and when they are completely intoxicated, he gains their consent to his plans, and proceeds to build.

The house is made of long grass woven into great squares, which are set up and bound together at the corners, forming the side. The roof is then made and put in place. A chimney is quite unknown, but an opening in the roof just above the hole in the floor which forms the fireplace, affords a means of escape for the smoke. The cooking is all of the simplest kind, and is done over this open fireplace, amid clouds of curling smoke and flying sparks.

A small platform extends around three sides of the room; this is about four inches above the floor, and is used as a common sleeping-place for the entire family. The bedding consists of little more than straw matting, which is used for covering, and also to sleep upon. If the ingenuity of a Yankee had been taxed to the last degree, a more complete device could not have been invented for the speedy killing off of a race than the houses and sleeping arrangements of these people in such a climate; yet they live and seem to thrive through the winter months.

There is but one window in the house. This faces the east, and is dedicated to the gods. It being sacred, no one is supposed to ever look out that way, and it is next to a crime to look into the room from the outside through this holy of holies. The only decorations about the window, if such they may be called, are the strange offerings to the farm gods. These are simply whittled sticks; clusters of shavings are stripped down to a certain point on a common pine stick, and left in a bunch. These are supposed to be well-pleasing to the gods.

Nothing could be more free from Oriental forms and pomp than the religious belief of the Ainu. In trying to study their customs as related to worship, I was reminded more of the Alaska Indian than of any other native race. Theirs (the Ainu) is a religion of spirits, which are ever crying for sacrifice in some form. Unlike other people, the Ainu offer only worthless objects before these wrathful spirits. Money is a rare quantity. They are destitute and poverty-stricken; hence they have devised a cheap offering which is put in every conceivable place, both within and without the house. A small pine stick answers the purpose, and shavings similar to those in the east window are placed at all points where the favour of the gods is invoked.

Agriculture in its most primitive and crude form is carried on to a limited degree. This North Island has always been considered valueless by the Japanese. It is only of late years that any attention has

been given to the development of the land and the settlement of the island. To their great surprise, when an experimental station was opened it was found to possess wonderfully fertile soil. In a short time, apples—supposed not to grow in Japan—were found to reach almost perfection. Over one hundred varieties were placed under cultivation, with the astonishing result that all developed into fine fruit, but it was under scientific methods. It is not so with the poor Ainu. He has no knowledge of the earth, and has never conceived a single idea whereby to lessen toil or draw from the soil the best it can yield; hence the people have no system of cultivation. The idea of enriching the land is quite unknown to them, and when, by reason of repeated use, it becomes impoverished, their only remedy is to "rest it" and begin to dig a new piece.

As they do not farm for the general market, but each for his own use, there is not a great variety of production. Beans are a common article of food, and are raised in goodly quantities; they are harvested in a very crude way. In the autumn when the beans are ripe, the plants are uprooted and dried in the sun; then the small white beans are taken out and placed in storage.

In harvesting the millet and rice the method is both unique and original. Among more progressive people it would be considered quite impossible, but as they have no idea of the value of time, it serves every purpose, and by plodding toil they finally accomplish the task of gathering the grain. Men, women, and children walk through the rice and millet fields cropping off the heads of grain with a sharp shell. This is only an ordinary mussel-shell used in its natural state. A small cord of elm fibre is passed through a hole made in one side of the shell near the hinge. By means of this string it is tied to the middle finger, the hollow side toward the palm. The stalk of the millet or rice is caught between the shell and hand, and when fully ripened readily yields to the pressure which severs the head from the stalk. Thus the entire crop is gathered into the house, where the grain is beaten out upon the floor.

When the farming is done and winter is upon them, they go far afield to hunt, bear being their desired game. A cub is especially prized, and is captured alive if possible, that it may be fattened for a village feast, which is the great social function of the year. The bear is roasted whole in a pit in the earth, and the whole village is utterly given over to feasting and pleasure.

The Ainu have no organised institutions of any sort. By common consent they seem to respect each other's rights, and there are few difficulties to settle among them. In one of the villages a self-appointed king rules, as he supposes, but is without power of any sort. He dresses in lordly style, carrying a sword, and is much respected by the people. But they are really governed by the Japanese, who have little interest in them beyond keeping them subdued, which is not a difficult matter. I found but one Japanese interested in them, and he had sacrificed all self-interest in trying year by year to present their claims to the Diet. Thus far he has succeeded to the extent that the Government has

appointed a Commissioner of Education, and will make an appropriation for suitable houses.

They are now reduced to a pitiably small number, only 20,000 remaining all told. This is said to be largely due to the increased drinking among them of Japanese spirits; but probably this is mere speculation, although it must be said they are greatly given to the use of liquor when they are able to obtain it.

THE GEOGRAPHICAL FOUNDATIONS OF RUSSIAN POLITICS.[1]

By Charles Sarolea, Ph.D., D.Litt.

Russia is the classic land for geographers. Nowhere else have geographical conditions left a more indelible imprint. Nowhere else have men felt more deeply the all-pervading influences of physical surroundings, of climate and of race. There are some countries, like England, where man has conquered nature, where nature has become the benevolent and ministering servant of man. There are other countries, like Russia, where it is nature that always threatens to enslave man. In few other countries have men been compelled to submit to that physical despotism with a more passive resignation, the resignation of a Tolstoi so representative of the race. And in no other country has nature given more cruelly and more emphatically the lie to the noble dreams of idealists. Idealists may dream their dreams, proclaim their systems, and claim their reforms. But the great natural, economic, climatic forces continue to follow their immovable course, heedless of systems and reforms. The political destiny of Russia seems to have been written not in the book of philosophy, but in the stern and sibylline book of nature; it has followed the bend of rivers and the curves of isothermic lines; and one guesses its mystery, and one catches its meaning more surely and more easily, by listening to the murmur of forest and steppe than by listening to the most plausible theories of revolutionists.

In this connection, and to illustrate my meaning from the outset, and to indicate what I am driving at, may I point out to you the utter futility and folly of most newspaper comments and discussions on the present situation in Russia. In speculating on the probable course of the Russian revolution, journalists are constantly reasoning on the childish assumption that the ultimate success or failure must entirely depend on the will, weak or strong, just or wicked, enlightened or obscured, of some one man or group of men, the Czar or the Grand Dukes, Mr. Witte, his friends or his opponents. If Russia could only be got rid of these Grand Dukes, and "of a few corrupt officials," then all would be right. Not only do they forget that behind the Czar and the Grand Dukes, and the high court officials, there is the large army

[1] An Address delivered before the Society in Edinburgh on February 18.

of the bureaucracy, with their immense power, with their vested interests, who are capable of paralysing and neutralising all the efforts of the most enlightened rulers, and of wrecking all the programmes of reform if they so choose, but they also forget that behind both autocracy and bureaucracy there is a factor infinitely more important still, and that is the passive resistance or active co-operation of one hundred and twenty millions of peasants, whom we totally ignore in our calculations, as if they were absolutely of no account. Unfortunately for our speculations and calculations, these one hundred and twenty millions, whether active or passive, *must* be taken into account, as the ultimate success of any scheme of reform necessarily depends upon them. After all in any country the people have only the government they deserve, and they deserve the government they have ; or to use the language of Carlyle, the rights of a people are equivalent to its mights, its needs and aspirations. But in a country like Russia, the needs and the mights of the people are largely determined by the conditions under which they live, and these conditions ultimately resolve themselves into facts of climate and distance, of soil and of race. It is therefore those physical conditions which are the real final factors of the political problem. Without an accurate and minute investigation of such factors, it is as futile to speculate on the relative strength of the forces of liberty and reaction as it would be to speculate on the resistance of the Forth Bridge or the Tay Bridge, without examining the strength of the foundations, without studying the special properties of iron and steel as well as the general laws of dynamics.

I. The Lessons of Physical Geography.

Now the first feature and the essential fact in the physical geography of Russia is the infinite plain, the uniform steppe and prairie, without any other undulations than the tumuli, or prehistoric tombs, or the high banks of streams, or the insignificant hills which separate the basin of the enormous, slow, aimless rivers. The chain of the Ural Mountains which separates Asiatic Russia from European Russia hardly breaks the continuity of the plain. The slopes of the Ural have been a passage rather than a barrier, and between the last slopes of the Ural and the Caspian Sea there opens a gate of three hundred miles in width which has always been the highway of invaders and marauders.

And this unity of the infinite plain is still rendered more striking through the unity of climate. In summer the same continental climate reigns all over the Empire, the same intense heat relaxes and enervates the inhabitants of Lake Ladoga in the north and the inhabitants of the Caspian shores in the south. In winter the same shroud of snow buries the whole Russian Continent from Poland to Siberia. The Sea of Azov and the northern Caspian Sea are frozen as well as the Gulf of Finland. And the traveller might drive and glide in his sledge in a straight line for 6000 miles from the Baltic Sea to the Pacific Ocean, from Archangel to Astrakhan.

Now, my point is that this single feature of the physical geography of Russia has determined beforehand the whole history of the Russian

people. You all know the admirable sonnet of Wordsworth on the subjugation of Switzerland by Napoleon :—

> "Two Voices are there ; one is of the sea,
> One of the mountains ; each a mighty voice ;
> In both from age to age Thou didst rejoice,
> They were thy chosen music, *Liberty.*"

Now if it be true that the voices of *sea* and *mountain* are the two mighty voices of Liberty, on the other it is even more obvious that the *plain* has ever been the arena and refuge of *despotism*. The levelling of the soil seems to be significant and symbolical of the levelling of men. Ernest Renan has told us that the desert is monotheistic, *i.e.* that the uniformity of the desert suggests and determines a belief in the unity of God. In the same way, one might assert that the plain is monarchic and autocratic. In all times and everywhere the plain has invited the invader, and in order to repel and expel that foreign invader the inhabitants have had to submit to the protecting yoke of a master: they have had to accept a military and centralised monarchy.

Examine on the map the few and scattered historic cities of Russia—Moscow, Novgorod the Great, Nijni Novgorod, Kieff, Kazan—generally situated on the border of the sheltering forest, or at the mouth or on the high banks of rivers. Each one of those cities with its Kremlin dominating the plain appears to us like a sentinel who watches and like a stronghold which protects, and that Kremlin, which is both an acropolis and a capitol, which is at once a fortress, a church and a city, tells us by its aspect of the violent destinies of the inhabitants. The whole of Russian history is one continued effort to drive out foreign invasion. In everlasting succession on each frontier arises a new enemy: Tatars of Kazan and of Crimea, Khirgiz of the Volga, Cossacks of the Steppe, Turks, Poles, Lithuanians, Germans, Swedes, towards the south and the west—the external danger has never ceased.

Speaking of the European coalition against France in 1792, Joseph de Maistre has been able to say that France could only be saved by a Reign of Terror. With how much more reason might one affirm that Russia could only be saved by an autocracy. It is Ivan the Terrible, Peter and Catherine the Great who have been the cruel and stern master-builders of the Russian people, the "gatherers" of the Russian soil.[1]

It is hard for a Briton, who has an instinctive worship and almost a superstition for liberty, to get reconciled with the principle of despotism. It is difficult for him not to see in that principle something diabolical, the source of all moral and political evil. And most difficult of all, most repugnant to his feelings, is it to admit that this abhorred autocracy can ever have been the very condition of the salvation of the country. But let us not forget that in the life of nations the principle of authority may be as necessary and therefore as legitimate as the principle of liberty. Let us not forget that even in your own history

[1] See the writings of Danilevski and Solovioff.

two of the most decisive epochs have been the military dictatorship of Cromwell and the civil dictatorship of Pitt. Let us not forget that the Romans, *i.e.* the nation who, of all ancient nations, have been the most successful in the practice of freedom and of self-government, did never hesitate to appeal to such dictatorship whenever the country was in danger. *Salus populi suprema lex.*

Now in Russia for centuries the country has always been in danger. Hannibal has always been at the gates of Rome. Tatars and Poles have always threatened the gates of Moscow. And fatally therefore despotism had to be perpetual, *dura lex sed lex*: a great evil, but a necessary one. Let us suppose for one moment that the Russians had adopted another form of government, and had remained loyal to the republican principle which we see prevailing in the most ancient commonwealths of Pskof, Viatka, and Novgorod the Great. What would have happened if Russia, instead of submitting to the iron hand of the Grand Dukes of Moscow, had risen against them, if republican freedom had triumphed? The reply to that question is written in the whole history of Poland which is inseparable from that of Russia. In the life and death struggle between the two great Slav nations, the Poles seemed to have every advantage: a race admirably gifted, brilliant, clever, proud, bold, the proximity of the centres of civilisation, a communion of sympathy and interest with Western Europe, a passionate love for independence. And yet it was tartarised and barbarised Russia that triumphed, it was civilised Poland which was crushed and blotted from the very map of Europe. She perished through freedom, through the abuse of the *liberum veto*. She perished because, in the supreme hour of danger, the Poles did not rally around their leaders, because they did not make to their government the sacrifice of their individualism. Russia, on the contrary, made that sacrifice; she trusted to the sword of her princes; she allowed herself to be saved by despotism. "Let Poland perish rather than principle!" seems to have been the motto of the Poles. "The safety of the country is the supreme law" was the motto of the Muscovites.

Let it therefore not be said that autocracy and militarism are a mere baneful accident in the annals of Russia, a system born of brutal force and which must perish by brutal force, a despotism only supported by exile and by Cossacks, and only tempered by Nihilists and by assassination. As I said at the beginning of this paper, nations in the long-run have only the government they deserve, and deserve the government they have. And when a government has succeeded in lasting for generations, it thereby clearly shows that it is adapted to the needs of and in conformity with the aspirations of the inhabitants. Now autocracy in Russia has endured for centuries; it has survived every revolution. Individual Czars may have been suppressed; the institution itself could not be suppressed. In times of national disturbance and national distress it has always appeared to the people, rightly or wrongly, as the supreme refuge. It has owed its existence not to chance, but to necessity. And this necessity seems so obvious, so imperative to every Russian who knows his history, that all Slavophiles, whatever may have been their

liberal tendencies, have upheld the autocracy, the "Samoderjavie," as the corner-stone of the political structure.[1]

Let me not be misunderstood. I am not justifying the ways and methods of autocracy. I am only explaining, in terms of geography, that autocracy has had a great historic mission to fulfil.

It may be that that mission has come to an end. It may be that the time has come when the principle of despotism must give way before the principle of political liberty. That the time has actually come seems to be the unanimous opinion of Europeans. It does not come within the limits of the present paper to enter into the merits of that controversy, but it is worthy of note that, in the opinion even of a very large number of liberal-minded Russians, the necessity for the maintenance of the autocracy still remains, for the very simple reason that the external peril remains, and the geographical situation of Russia is still the same. For whatever may be the aspirations of the Russian nation, peaceful by temperament, and which has ever preferred the defensive to the offensive, they must watch, their hands at the hilt of the sword. For, far beyond at the Western frontier there also watches the Teuton, who himself seems to give an ominous warning to the Slavs, by the very form of government which he has freely chosen. Germany, in order to be stronger for the attack as well as for the defence, has given up the liberal federal principles which she has practised for centuries; she has sacrificed the autonomy of her innumerable principalities in order to adopt, in the age of democracy, the stern principle of autocracy. Voluntarily she has intrusted her destinies to the sword of the Hohenzollern. With such a precedent on the part of the highly cultured and progressive Germans, revolutionists seriously propose that Russia, at the most critical moment of her history, should break up her political unity, which has been the work of ages, which has been imposed by nature and by climate and by geographical position. To this proposal every Russian statesman has the right and the duty to oppose an emphatic *Non possumus!*

II. The Lessons of Economic Geography.

Such are the teachings of physical geography. Let us consider what are the lessons of economic geography.

Leaving aside the frozen marshes of the extreme North only inhabited by the Laplander and the reindeer, and the salt deserts of the extreme South only crossed by the nomadic tribes and the camel, European Russia is divided into three zones or regions: the region of primeval forests in the north, the region of the grassy steppes or prairies in the south, and the intermediate region of arable land, that famous "black soil" of wondrous fertility, which it is only necessary to scratch for the harvest to burst out as by enchantment. Although these three regions are

[1] In the course of an interview with Tolstoi, that great writer repeatedly emphasised to me the importance of studying the "Slavophile" theories, in order to understand the situation in Russia.

clearly characterised and distinct, they are nevertheless mutually interdependent. The dwellers of the forest need the produce of the black soil, the granary of Russia; on the other hand, the inhabitants of the agricultural plain need the fuel and the building material of the forest, as coal and stone are generally wanting. And still more does the plain need the moisture of the forest, without which the droughts and famines which at present are only the periodical scourge of Russia would be her permanent curse. And finally, the grassy steppe or prairie is the "hinterland" of the black soil. Not only does the arable land encroach every year on the steppe, but without the possession of that "hinterland" the inhabitants of the plain, as in the legendary days of the Cossacks, would have been always at the mercy of incursions and invasions.

Through those three zones Russia is a huge agricultural community, distinct from industrial and commercial Europe; it is an Eastern Europe of wheat and wood distinct from the Western Europe of iron and stone. The peasantry constitute eighty to eighty-five per cent. of the total population.

No doubt in the last generation the existence of prodigious mineral wealth has been revealed in the centre, in Poland, in the Donetz, in the Ural. The industrial exploitation of these regions has begun and very rapidly developed. But for ages to come the industrial production of Russia will scarcely meet the demand of the home market. Russia will continue to buy from the foreigner *and will remain an agricultural nation.*

Now in all countries and in all times an agricultural, non-industrial, non-commercial nation is essentially conservative, almost blindly respectful of all traditions and all authorities. Its political progress is much slower, even though it may be safer. But in Russia the peasantry are incomparably more conservative than anywhere else. In the first place they are more religious, or, if you prefer, more superstitious. For centuries they have identified themselves with the cause of the Orthodox Church. In the Russian language the same word means peasant and Christian: *krestine.* For centuries the Russian peasant has in turn repelled the Mohammedan invasion of Tatars, the Catholic invasion of Poles, the Protestant invasion of Teutons, the freethinking invasion of Jews. To the Russian peasant, and mainly owing to the geographical position of the country, nationality and religion are synonymous terms. All the Slavs are, and must be, "pravoslavs" or Orthodox.

But, in addition to this religious cause of the conservatism of the peasantry, all physical conditions seem to neutralise and check political movements. Nature herself seems to conspire against political conspirators and seems to defeat their schemes: climate, the enormous distances and the difficulties of communication, the absence of roads, the scarcity of cities, explained by the absence of a middle class—which is itself explained by the primitive conditions of trade and industry—all these causes are in the way of political agitation.

To understand the radical differences of the conditions of life in Britain and in Russia, compare a British village with a Russian village. The British village appears to us as a highly differentiated political

organism with its hierarchy of classes, its division of social labour: at the summit a small aristocratic community of landed proprietors presided over by the lord of the manor or the local magnate; an intermediate middle class of farmers and tradespeople led by the clergyman and the schoolmaster; at the base a democracy of artisans and farm labourers: from the highest to the lowest rung of the social ladder, an intense political and religious life, which is favoured by the close proximity of the town, the continuous exchange between town and country, the rivalry of sects, the grouping of parties, the establishment of clubs and societies for the enlightenment and diversion of the inhabitants. Now practically none of these conditions exist in the Russian village. There is no ruling class. Estates are too scattered, too wide apart to render social relations possible. The landowner, if he is rich, will spend his income in the Russian capital or in European health or pleasure resorts; for nothing except a high sense of duty could induce the magnate to reside. If he is poor, and compelled to remain on his estate, he will vegetate in the most lamentable intellectual isolation. The clergy are demoralised by their bureaucratic subjection, by their ignorance and poverty, and have very little moral influence over the peasants. There is no middle class, for either trade does not exist or is in the hands of the Jews and the Germans. The peasantry, absolutely abandoned to themselves, are without any contact with civilisation. Isolated from the city, riveted to the soil, nearly all illiterate, the din and turmoil of life only reaches them as a distant murmur. I do not mean to say that these peasants are entirely dead to political life. On the contrary, they possess a very active local government, and that local government, represented by the "Mir" or village community and the "Zemstvo" or County Council, may even be said to be by far the most original and interesting of Russian institutions. But the activity of the "Mir" and of the "Zemstvo" is above all of an economic and administrative order. It does not extend beyond the border of the village. It does not free the peasant from his intellectual isolation.

Now to imagine that these one hundred and twenty millions of Russian peasants, thus riveted to the soil, thus living under the pressure of poverty, in ignorance and isolation, should be mature for revolutionary utopias, seems to me to be the wildest of dreams. However prodigiously fertile the Russian soil may be, and however gifted the Russian people, political freedom does not grow in a day like the grass of the steppe, it is not a plant without roots in the past, in the traditions and the manners of the people. No doubt the peasantry may be got to rise in some bloody "jacquerie." They might be drawn into some agrarian revolution—like the Pougatchef revolt in the eighteenth century—which would satisfy their craving for possessing and extending the soil they cultivate. But the hunger for land once satisfied, the peasantry would again become conservative, like the French peasant proprietor after the French Revolution, and so far from joining any mere "intellectual" revolution, they would dread such a revolution as a possible reaction and as a menace to their newly acquired rights.

No doubt the political evolution of the rural masses will come

sooner or later. Popular instruction will spread. Proprietors will be induced more and more to reside on their estates. Religious freedom and the threefold struggle against Catholicism, nonconformism, and rationalism will compel the Orthodox clergy to emerge from their ignorance and their subjection. The priests will receive a better education and thereby acquire a moral authority which will enable them in turn to educate their flocks, hitherto so sadly neglected. And above all, with the progress of trade and industry there will arise a middle class, and with the middle class a strong and independent opinion, which is the prime condition of all political liberty. But even when these great changes are accomplished, when a ruling class and an independent class are constituted, the rural masses and their leaders the clergy will continue to respect the established authorities. For generations to come the peasantry and the clergy will continue to see in the Emperor and in the Church their spiritual and temporal Providence, a patriarchal and beneficent despotism. In one word, the Revolution in Russia will be *conservative*, or will be a failure.

III. The Geographical Distribution of Races.

We have seen so far that physical geography and economic geography are unanimously on the side of tradition and conservatism and against the Revolution. What can we learn further from the geographical distribution of races?

We have already emphasised the fact that for ten centuries Russia has been a debatable land, *Terra nullius*, open to all barbarians and to all nomads. For ten centuries these barbarian hordes have swept like torrents over the plain. But ever on the fertile steppe the green grass would grow again after the horse of Attila had passed. The forty-eight races which are scattered all over the empire represent the alluvial strata of these barbaric invasions. The ethnographical map of Russia tells us of the migrations and revolutions of races, even as the geological map tells us the revolutions of the crust of the earth. Tchoudes and Tchouvachs, Tatars and Tcheremisseans, Kalmouks and Khirgiz, Finns and Samoyedes, Georgians and Lesghians, Persians and Armenians, Jews and Roumanians, Germans and Swedes, Poles and Lithuanians, Great Russians, White Russians, Little Russians—each unit of this Babel of nations is a living witness of a tragic past.

At first sight the geographical distribution of races seems to contradict the political lessons of physical and economic geography. Physical and economic geography proclaim the unity of the Russian Empire and the historical necessity of autocracy. Ethnography, on the contrary, seems to proclaim the infinite diversity of the Czar's dominions and the necessity of autonomy: for it seems as if so many heterogeneous races could not live under one power and one law.

But let us observe that these races are not only different but irreconcilably *hostile*. And the instinctive hostilities of race are complicated by differences of language, of religion, and of habits. To compel all those races whom the vicissitudes of history have thrown together on the

same territory to live in peace, we must needs have an energetic, military, centralised government, which may play the part of umpire and peacemaker, and which may refrain and repress spontaneous anarchy and civil war always ready to burst out. To all these peoples the Russian Empire has brought the same supreme benefit as the Roman Empire: *Pax Romana*, the Peace of the Czar.

Therein precisely consists the civilising part which Russia has played for centuries. Recent events, the massacres of Jitomir and Odessa, so far from contradicting this truth, only confirm it. As soon as, in consequence of the external disasters and the internal agitations, the Russian Government began to lose its authority together with its prestige, as soon as it had to recall its regiments and to send them to the Far East, at once the destructive forces reigned supreme, and religious passions, racial hatreds, got free play. The Poles murdered the Russian officials, the Russian peasants murdered the Jews, the Tatar insurrectionists murdered the Armenians. I know full well that these massacres have been attributed to the government itself, which wanted to create a diversion, carrying out the old device: *Divide ut imperes.* The massacres have been imputed to agents of the secret police, to the famous "black gang" or "tchornia sotnia." But I must frankly confess that I would rather believe in the most absurd legends of the Middle Ages, in the ritual murders, in the crimes of witches, than believe in the monstrous folly of a government which would have organised those very riots and disorders which it is its duty and vital interest to suppress. No doubt subordinate agents may have taken advantage of the prevailing anarchy to achieve their wicked ends; but they only obeyed their own evil instincts, not any order of the government. How could the government have organised massacres, when it had practically ceased to exist? And let it not be said that such a design would be worthy of a "diabolical" government! For such a policy would not even deserve to be called "diabolical," it would be simply idiotic and imbecile, because any disorder would ultimately turn against the government itself. And not even the Evil One has ever been accused of stupidity.

No, in truth, the explanation is less monstrous. The lamentable recent events are simply the outbreak of what Taine has called "spontaneous anarchy," or the spontaneous generation of anarchy. It is the primitive instincts of race, the barbarous passions of the mob, which, hitherto dormant and latent, hitherto repressed by the iron hand of government, have suddenly burst out and swept everything before them as soon as that obstacle has disappeared. If autocracy or a strong military power did not exist in Russia the massacres of Jitomir and of Odessa would alone suffice to demonstrate the necessity of its existence in the interests of humanity and civilisation.

And thus the ethnography of Russia teaches us exactly the same lessons as physical and economic geography—the vital necessity of a strong government. It shows the danger, not to say the impossibility, of the two principal articles of the revolutionary programme—parliamentary government and nationalist autonomy. The remedy might be worse than the disease; it might kill the patient. A centralised parlia-

ment in which twenty nationalities would be represented by twenty irreconcilable parties, would deliver Russia to legal anarchy, that is to say, the very worst of all forms of government. A nationalist autonomy which would do away with the restraint of the central power, umpire, and peacemaker, would be the signal for a general racial war. In an autonomous Poland, Jews and Poles, Russians and Lithuanians, Catholics and Protestants, Socialists and Reactionists, would give an outlet to their deadly hatred. An autonomous Armenia or Transcaucasia would become a chaos and an inferno. I have rapidly passed through that inferno, and my nerves are still shaking at the mere recollection of the horrid sight.

And that is why, even though one might be a decided supporter of political autonomy everywhere else in Europe, one could not be so in Russia any more than in British India. To re-establish, as the revolutionary parties demand, the ancient autonomous elements—would not merely be to disintegrate the Russian Empire, it would be to destroy the work of centuries, it would be setting back the clock of history, it would be bringing back the "Smoutnoe Vremia," the dark times of racial and national wars. No, in Russia for many years to come it is not the moderate liberals and the moderate conservatives, but the radicals who are the true reactionists. It is not the separatist party but the unionist party who know how to interpret the lessons of history and geography and ethnography, and who are working for civilisation and progress.

IV. The Geographical Orientation of Russian Foreign Politics.

If there is one eternal and universal instinct in human nature, it is the irresistible impulse which attracts the inhabitants of northern countries to the sunny climes of the South and the East. It is this same *heliotropic* instinct which directs the flower towards heat and light. It is this same instinct to which Goethe has given immortal expression in the "Song of Mignon." It is this same instinct, which for ages has transformed Italy, the land of beauty, into a land of servitude. It is this same instinct which has directed the colonial expansion of Great Britain, and which in our own day is drawing the German to the East.

With no other nation has this "Drang nach Süden" and this "Drang nach Osten" been so natural and so intense as with the Russian people, because no other nation has been so disinherited by nature, no nation has been so entirely bereft of heat and light. In the empire of the Czar there are only two regions which are not subjected to the dominion of winter, the Crimea and Transcaucasia. Hence the value and prestige which for every Muscovite attach to these "Diamonds of the Crown." Hence the great part which these southern provinces have played in the Russian poets and novelists; the Crimea and Transcaucasia are to a Russian what Switzerland and the Riviera, what Italy and Greece are to an Englishman or a Teuton.

Geography itself seems to be in Russia the accomplice of that "Drang nach Osten" and that "Drang nach Süden" in which we only see a spirit of aggression. It is a striking fact that the three great

rivers of Russia, the Dnieper, the Don, and the Volga, all flow eastwards and southwards. And as these three rivers are the vital arteries of Russia, as they are the three great routes of migration and invasion, the three highways of commerce, as they have determined the direction of the whole history of the Russian people,—we may say that Russia, in "orientating" her foreign policy southwards and eastwards, has not only obeyed an instinct common to all that lives and breathes, but has merely followed the trend of her enormous rivers, carrying slowly but surely the destinies of those Northern Barbarians towards the Sunny South.

But in addition to the *heliotropic* instinct characteristic of all Northern peoples, in addition to the "oriental" trend of the great rivers, there is still another potent impulse which has given its direction to Russian history, and which an Englishman ought to be the last to ignore, and that is the desire to possess a free outlet to the sea—the sea which, so far from separating nations, binds them together, the sea which will bring Russia nearer to the cradle of religion and civilisation, which will transform the agricultural Russia into a commercial and industrial Russia, which will bring, together with trade and wealth, freedom and power.

Remember the famous page where the Greek historian describes to us the solemn and blessed moment when, after long months of expectation and suffering, the Ten Thousand Companions of Cyrus and Xenophon finally perceived the sea, supreme object of their desires. *θάλασσα!* *Thalassa!* the cry which two thousand years ago burst from the breast of the Greeks, has also been the sacred cry of the Russians! *Thalassa!* This cry sums up their whole history; for Russian history in modern times is nothing but an endless "Expedition of the Ten Thousand," a long effort to reach the "*open Sea.*" *Thalassa!* expresses both the past and the future of the people; all the realities which they covet and all the ideal things which they dream of.

For the aspirations of religion combine to strengthen and to sanctify the blind desires of instinct; for the "Drang nach Osten" will not only bring material wealth, the contact with civilisation; it also means the realisation of the religious destiny of Russia. The protectorate over Turkey and Asia Minor would be the enfranchisement of the Slav nations of the Balkans, of the Orthodox brethren weighed down by the cruel yoke of the Turk, and it would involve the protectorate over Byzantium and Jerusalem, the two holy cities of the "Pravoslavs."

The Oriental and Asiatic policy of Russia is, therefore, not a policy of adventure and conquests; it is a natural and national policy, and from the Russian point of view a perfectly legitimate and indeed a necessary one. The will of Peter the Great, whether it be authentic or not, corresponds to a reality: it is the sacred inheritance and the historic mission which Russians for the last three centuries have transmitted from generation to generation. The struggle for the possession of Constantinople, "Tsargrad," both the capital of the Cross and of the Crescent, is the only one which has always rallied all the subjects of the Czar, all political opinions, and all political aspirations. The conservatives, the

Church, and the peasantry desire this policy because it must ensure the triumph of Orthodoxy. Liberals and "Occidentals" and intellectuals desire it because it will compel Russia to emerge from her isolation, and must bring her nearer to the centres of civilisation. Realists and Jingoists desire it because it must bring with it wealth and empire!

All these desires and all these dreams have just suffered a terrible check through the disasters in the Far East. Therein resides the pathetic interest of the Russo-Japanese War. Therein also lies largely the explanation of the present internal convulsions. For generations Russia had been advancing slowly but surely towards the ultimate goal of what she considers her "historic mission." Like a weary traveller, exhausted by a long and last march, and who, arriving near the end, wanting to make one supreme effort to hasten on the desirable consummation,—falls down prostrate, in view of the promised land—even so the Russians, on the eve of achieving their dreams, after having patiently waited for centuries, were suddenly seized with a feverish impatience and tried to hasten on events. They have failed, and they have paid for their impatience with the temporary ruin of their hopes, with unheard-of disasters and with a tragic revolution.

THE ANCIENT GEOGRAPHY OF GALICIA.

THE Gardens of the Hesperides, with their fable of gold, and of the dragon overcome by Hercules; the Cassiterides, famous for its tin, and long reputed to be identical with the Scilly Islands; the territories of Oestrymnis and of Ophiusa; where can they be located in our modern maps with any degree of accuracy? These questions have interested geographers of all modern times; our own Camden, who influenced many other writers; Müllenhoff, Ch. Müller, Lemaire, Ukert, and many others have studied the old writings, and the ancient maps, and have done all that erudition may do to fix the identity of sites. Still the discussion is far from being closed; and now there appears in the *Boletín de la Real Sociedad Geográfica*, vol. xlvii., an exceedingly able and interesting contribution from the pen of Señor Don Celso García de la Riega, of which we propose to give a short notice.

What the writer sets himself primarily to do, is to traverse the opinions of two of the most recent Peninsular writers, Señor Don Martins Sarmento, a Portuguese authority; and Sr. Costa, who published *Estudios Ibericos* in Madrid 1891-95. While endeavouring to do this, García de la Riega has also given a fairly exhaustive epitome of the opinions of geographers of to-day on the subject.

The main source of information in all these investigations is the *Ora Maritima* of R. Festus Avienus, a Latin writer of the fourth century.

Avienus' work was compiled from the voyages of the older writers, many of them very inexact; and it is to be remembered that the contours of what Gladstone, in his *Homer*, calls the *outer* geography,

were very incomplete. The text of the poem has always been the same, but the interpretation thereof has differed almost with each writer; and it is the interpretations of Sarmento and Costa that García de la Riega sets himself to combat. For instance, Sarmento says, that Oestrymnis was a region in England; on the other hand, Costa locates Ophiusa at a distance from Oestrymnis, on the coast of Valencia, Editania of the ancients. García de la Riega holds, and this is the substance of his article, that the Hesperides, the Cassiterides, and the Oestrymnic islands are one and the same; that the Oestrymnic promontory is Cape Finisterre, and that this Oestrymnis lies in the centre of Ophiusa, which is none other than the country we now know as Galicia. This is the cream and substance of the paper, the whole of which is taken up with proving these contentions in detail.

For the convenience of the student, the writer has given at the end of the article, in the original Latin, that part of the *Ora Maritima* which deals with Oestrymnis-Ophiusa (line 80 onwards), and in the text, he adds a rough rendering into Spanish of what he considers the sense of the passage. Several of the sentences he considers to be digressions, and these he puts in parentheses. Certain statements, which he looks on as errors, relating chiefly to distances, he inserts in italics:—"From the waters which surround the world issues the gulf of the Atlantic, which approaches to join our sea in the Gaditanean strait. In the first, appears prominently the Oestrymnian cape, facing towards the south; at its feet opens the Oestrymnian gulf, out of which project the Oestrymnian islands situated out in the sea; they are extensive, densely populated, and abound in tin and lead. (From that region to the island of the Hibernians, near which appears that of the Albions, are *two days* of navigation.) In the extreme limits of the Oestrymnian people, diverse nations traffic. The Carthaginian Hamilco made in these seas a voyage of four months, and found in various stopping places some difficulties, such as little depth in the water, and marine vegetation which hampers the movement of ships. (The venturesome mariner who from the Oestrymnian islands may steer towards the cold countries of the north, will encounter a rocky and arid district, inhabited by Ligures driven out of their country.) Returning to the places indicated above, you find the great gulf towards Ophiusa; from the border of this gulf to that of the sea called Sardam, takes a pedestrian *seven* days' journey. The side of Ophiusa, formerly called Oestrymnis, is equal in size to the island of Pelope. In that part is the cape of Venus, near which are the uninhabited islands. Soon appears the cape of Arvii, directed towards the north, and from that port to Cadiz, ships take five days; after that comes the Pelagian island. (Besides this, from the cape of Arvii there are two days of navigation to Ophiusa superior, before which opens a long gulf navigable in half its extent with a west wind, and the remainder when the wind is in the south.) Returning to where we were, the road by land to the coast of the Tartessians takes *four long days*, and the road to Malaga in our sea *five*. Soon rises the Cepresic cape, and near it is the island Achale. (The Cempsii and the Saefes live in the slopes of Ophiusa, and near to them live the Ligii and the

Draganes; but to the Saefes belong a capacious port (Patulus Portus) and the island of Paetanion.) The Cempsii march with the Cynetes; in the coast of these latter the Cynetic cape projects out to the ocean, and is the extreme of Europe. After this, one finds the mouth of the river Ana, which furrows the land of the Cynetes; *soon are the two islands Agonidas within sight of the cape Cautes.* From the Cynetic cape is one day's journey to the said river Ana, which is the frontier of the Cynetes with the Tartessi," and so on.

As we have indicated above, García de la Riega has considered that certain passages in the poem are to be looked on as digressions, and as having nothing to do with the general description of the itinerary; and these he has enclosed within brackets. Another point is that for various reasons he assumes that Avienus would naturally commence with the point farthest away, and least known; and would carry the reader homewards towards the more familiar places. Eliminating therefore entirely the place-names mentioned within parentheses; and taking only those which, according to the writer, belong to the general description, we get the following arrangement of sites:—Ophiusa superior, and a gulf navigable with two winds. The extreme end of the Oestrymnian region. The cape of Oestrymnis. The gulf of Oestrymnis. The islands of the Oestrymnians (Patulus Portus and the island of Paetanion?). The cape of Venus and the two uninhabited islands. (Agonidas?) Cape of Cautes? Cape of Arvii. Pelagian island. Cepresic cape. Island of Achale. Cynetic cape. River Ana, etc.

IDENTIFICATIONS (beginning with the furthest away point).

Jugum Oestrymnis = Cape Finisterre.
Sinus Oestrymnicus = Gulf from Finisterre to Silleiro.
Insulæ Oestrymnidum = the peninsulas of Finisterre, Corcubion, Muros, and Carnotas, Corrubedo (with those of Carreira, Maño, and Chazo), Salnes (with that of Grobe), Morrazo (with that of Hio or Donon), and Grova or Bayona.
Insula Hibernorum and Ins. Albionum = the islands of Great Britain and Ireland.
Terminos Oestrymnidum = Coruña.
Magnus Sinus = the ocean.
Ophiusa = zone of the Cantabrian and Galician coasts, with part of the Portuguese.
Mare Sardum[1] = Gulf of Lions in the Mediterranean?
Veneris Jugum = Punta de la Lanzada.
Duæ Insulæ Inhospitæ = the islands of Ons.
Arvii Jugum = Cape Silleiro.
Insula Pelagia = Insula del Miño.
Ophiusæ Prominens = region of Capes Ortegal and Estaca de Bares.

[1] The allusion to the Mare Sardum is undoubtedly a difficulty, but it is commonly identified with the Gulf of Lions. García de la Riega therefore thinks that the journey was meant to be overland, across the isthmus, and that the period of seven days has been an error in calculation due to the defective sources from which Avienus derived his information.

Sinus X, "zephiro vehente" = Gulf of Gascony, or from Cape Tosto to Ortegal.
Cepresicum Jugum = Capo de la Roca, in Portugal.
Insula Achale = Peninsula between the bays of the Tagus and the Sado.
Patulus Portus = inlet of Arosa? *Fiord* is perhaps the better word.
Insula Pœtanion = the island of Arosa?
Cyneticum = Cape St. Vincent, in Portugal.
Amnis Ana = the Guadiana river.
The Two Islands Agonidus = islands of Ons?
Cautes = Cape Couso? etc. etc.

The rest of the article is occupied in urging at great length each point of identification, but these points are mostly well known to the student. The writer knocks the bottom most vigorously out of the legend of the Scilly Islands; but this has been pretty thoroughly done before. As the learned Müllenhoff says, there is no tin in the Scillys, and there never was. Moreover, it is not two days from England, but some six hours. He considers that the mistake arose from the inaccuracy of the very early maps, the makers of which imagined that the line of the French coast continued in a straight line due south as far as the Cape de la Roca in Portugal; and that the islands of the Hesperides, Cassiterides, or Oestrymnis, all being one and the same, projected into the ocean farther west than they really did. This conception of identity is strengthened by the knowledge that the Phœnicians and the Greeks used the same word to describe islands and peninsulas, as seen, for example, in this very poem of Avienus, where he speaks of the Peloponesus as "insula Pelopis." In furtherance of this identification, García de la Riega gives a graphic and beautiful description of the coast scenery of Galicia; the bold headlands, the deep fiords, the bays and inlets, the luxuriant vegetation, which the traveller would see after the long voyage up the wellnigh unbroken and inaccessible coastline of Portugal. The gold, the tin, the copper all are there; the capacious and hospitable harbours, the pastures rich in flocks, and the hardy race of seamen. If space had permitted, we should have willingly dwelt on the comparison of the Oestrymnic gulf with Cape Finisterre and the gulf sheltered behind it, showing how the description of Avienus is almost photographic.

These points, and all the arguments for and against, are well known to the student of ancient geography, and we have done enough to bring before our readers some of the general sense of a most interesting and instructive contribution.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lectures in March.

A Meeting of the Society was held in the Free Assembly Hall, Mound, on the evening of the 19th March, when Mr. Charles J. Wilson,

F.R.S.G.S., delivered a Lecture on "The South African Colonies as seen by the British Association in 1905," Professor James Geikie, D.C.L., LL.D., F.R.SS.L. and E., President of the Society, presiding.

On the following evening, Mr. Wilson repeated his Address before the Glasgow Centre, when Dr. E. Duncan took the Chair.

Mr. Wilson addressed the Dundee Centre on the evening of 21st March, Mr. R. B. Don, J.P., occupying the Chair.

On the 22nd March, before the Aberdeen Centre, Mr. Thomas Murdoch, F.G.S., delivered a Lecture entitled "Ceylon, the Pearl of the East," Mr. John Clarke, M.A., presiding.

Meeting of Council.

At a Meeting of Council held on March 20th, the undermentioned ladies and gentlemen were elected members of the Society, viz.:—

Lieut.-General Sir R. G. Hay, K.C.B., R.A.
David Waldie.
Charles Dobson.
John MacLaren, M.B., C.M.
J. C. Christie.
Captain J. R. Young.
Robert Nicol.
Admiral Sir Arthur Farquhar, K.C.B., J.P., D.L.
Mrs. Georges.
Kenneth J. Allardyce.
David Douglas.
C. M. Pattullo.
John Robb, M.D., I.M.S.
Horsep Palandjian.

The Ordinary Diploma of Fellowship was conferred upon Miss Ada L. A. Murcutt.

OBITUARY.

MR. COUTTS TROTTER.

Through the death of Mr. Coutts Trotter the Royal Scottish Geographical Society loses one of its earliest and most loyal supporters. He was the eldest son of Mr. Archibald Trotter of Dreghorn, Midlothian, and was born in Edinburgh in April 1831, where he also received his preliminary education. Later on he was sent to Rugby at a time when Dr. Arnold had recently left it and had been succeeded by Dr. Tait. As he was intended for the Civil Service in India, his next move was to Haileybury, where he distinguished himself as a student, and carried off, among other distinctions, the gold medal for Political Economy. Although endowed with an excellent memory and a keen desire to learn, he was unfortunately less well equipped for future work from a physical point of view. By constitution he was delicate, and this showed itself very early in life. His first great disappointment was to find, on arriving in India, that his health could not possibly stand the climate. Although appointed to the Bengal Presidency he never went further than Bombay, and had to return home almost immediately. After a few months in Scotland he again essayed a voyage to India, but

the effort was in vain. He had to return without joining his post, and to his great mortification was obliged to abandon all hope of a useful career in the East India Company's service. With a mind always bent on the acquisition of fresh knowledge, he then entered himself as a student at Balliol College, Oxford, where he studied only for a short time, as the climate disagreed with him, and he had to leave without taking a degree.

Four years later he married, in 1862, the youngest daughter of the Right Hon. Richard Keatinge, one of the Judges of the High Court of Justice in Dublin; and nine years afterwards, in 1871, he settled for the benefit of his health at Bournemouth, where he lived for about eleven years. During all this period his health was anything but strong, and every year he had to spend several months on the Continent with his family. But he could not be idle. His reading was largely in the direction of books of travel, and his literary work took the form of reviews. From 1873 to 1902 he contributed regularly to the *Athenæum*, and a little later he began reviewing for the *Academy*, and continued to do so till it changed hands and entered upon a new departure. In 1876 and 1877 he wrote articles for the *Quarterly Review*, in which he summarised a number of books relating to Kashgar, Pamir and Tibet, New Guinea and the Islands of the Pacific—all parts of the world towards which he felt more especially attracted.

In 1882 he left Bournemouth and settled in Edinburgh, where he became intimate with the Rev. Robertson Smith, then editor of the *Encyclopædia Britannica*. At his suggestion Coutts Trotter wrote the articles on Fiji and New Guinea, for which his previous reading had well qualified him, though he had not at that time visited them. Towards the end of 1884 the Royal Scottish Geographical Society came into being, and he never lost a lively interest in it to the day of his death. Whenever he was at home, in fact almost up to the last, he was regular in his attendance at committee meetings, besides taking his share in reviewing books for the *Magazine*. Even latterly, when his health was so shattered that ninety-nine men out of a hundred would have shirked the work, his interest in the Society was so great that he continued to attend meetings, though it was distressing to see his feeble condition.

In 1886 he was ordered a sea voyage which gave him an opportunity of seeing with his own eyes countries he only knew of from much reading. In the course of a year he visited Fiji, Tonga, Samoa, and Australia, and from his highly sympathetic nature he everywhere made lasting friendships with those who were most worth knowing. While at Samoa he was appointed Pro-Consul of the island by the British Consul, Mr. W. Powell, to fill the interval between Mr. Powell's departure and the appointment of his successor. This incident brought him into closer contact with the natives and enlarged his opportunities for studying native life. The result of this experience was afterwards embodied in a communication to the Anthropological Institute. The year after his return he was advised to try the climate of Teneriffe, and in 1889 he spent some time in Algeria. In 1893 he went to the Cape. Next year he was in Egypt and the Syrian coast,

and in 1897 he went with the British Association to Canada. His last trip abroad for the benefit of his health was to Cairo in 1898, his first visit to the Nile having been in 1849. From all these countries that he had visited he brought back a great store of recollections and friendships, for, owing to his eminently sociable and companionable instincts, this was far easier than to lay in a store of renewed health. Coutts Trotter was a many-sided man, familiar with the literatures of France, Italy, and Germany, and he knew enough Dutch to be able to read it. By nature a humanist, he liked the society of his fellow creatures, enjoyed exchanging ideas with men of congenial spirit, and was thoroughly happy in intellectual society. On these occasions he gave as much as he received, for his well-charged memory was replete with interesting reminiscences of what he had seen and read. He was loyal in his friendships as in everything else, and those that knew him best will most miss the sound of his gentle voice.

REV. DR. JAMES STEWART, Hon. F.R.G.S.

James Stewart, M.D., D.D., Missionary and Explorer in Africa south of the Equator, died at Lovedale, Cape Colony, on the 21st December 1905. He was buried by a great gathering of Kafir followers and European friends on the top of Sandili's Kop there, overlooking the great Institution which he had built up. His name is for ever associated with that of David Livingstone, whose first book, *Missionary Travels*, and heroic example inspired him to enter on his lifework in 1857. Dr. Stewart was a member of our Society from 1892, and he was twice an honoured Member of Council, in 1892-94 and in 1901-1903. Here we have to record chiefly his services to Geography, to what he called Politico-geography, and what has come to be recognised by science as Anthropo-geography.

Son of a Perthshire farmer, he was born in Edinburgh on the 14th February 1831. As he passed through the Arts classes of the Universities of St. Andrews and Edinburgh, and the theological classes of the New College, Edinburgh, he kept ever before him the one aim of going out to the wide world as a missionary explorer. He graduated M.D. in Glasgow. Livingstone's book and letters summoned him to Tropical Africa, whither he accompanied Mrs. Livingstone when she joined her husband only to die at Shupanga. Stewart's first exploit began in February 1862, when the party entered the Kongone mouth of the Zambesi, helped by Captain John C. Wilson, commanding H.M.S. *Gorgon*, one of the slave-cruising squadron. In the subsequent two years, alone in a canoe, he ascended the Shire river and then the Zambesi to the Kebrabasa rapids, and satisfied himself that the line of advance must be north by Lake Nyasa and not west by the Zambesi. He was then joined by Livingstone, who had been disappointed by his examination of the Rovuma, and the two had much converse, in Portuguese territory, and subsequent correspondence as to the plans which led to the opening up of Nyasaland. Stewart wrote in the *Sunday Magazine* afterwards a series of charming "Recollections of Dr. Livingstone and the Zambesi."

The failure of the Universities Mission led to Stewart postponing the foundation of a mission there, and he was sent out to the Free Church of Scotland's Institution at Lovedale, in Kafraria. On his revisiting Scotland, the burial of Livingstone, in which he took part in Westminster Abbey, prepared Great Britain for action in East Tropical Africa. Stewart succeeded in founding the Livingstonia Mission in 1875. Having preceded the first expedition under Dr. Laws and Mr. S. D. Young, R.N., he sailed from Algoa Bay with the second expedition of seventeen Europeans, which reached Blantyre and Lake Nyasa in October 1876. In the next fifteen months he and Dr. Laws completed the second circumnavigation of the Lake, running the *Ilala* steamer by turns of three months each at a time. They carried the unfortunate Captain Elton's party from the Murchison cataracts to the north end of the Lake, 500 miles. The *Proceedings of the Royal Geographical Society* contain the record of Stewart's doings and his maps, in this the second of his contributions to geographical science. In December 1877 he returned to Lovedale, after giving five years of his life to the exploration which culminated in the establishment of the Protectorate of British Central Africa.

On his next visit to Scotland in February 1891, Dr. Stewart read to our Society, in Edinburgh, Glasgow, and Aberdeen, a remarkable paper "of a politico-geographical kind," on Southern Africa, Past and Present. It was marked by his fine Christian imperialism, and revealed to Scotland the true position of the Native question, in the past and still more in the future. Read again to-day, in the light of the Boer conflicts and "the miserable influence of party politics," the lecture is the production of a statesmanlike mind, a wise philanthropist, and a safe scientific observer. These views and the history of South Africa in the subsequent eleven years he elaborated for the Duff Missionary Lectures of 1902, in his *Dawn in the Dark Continent*, with Mr. J. G. Bartholomew's maps, of which a second edition is in the press.

Stewart had hardly resumed his duties as Principal of Lovedale when, at the request of the late Sir William Mackinnon, Mr. Peter Mackinnon, Mr. A. L. Bruce, Sir John Usher, and other members of our Society, he left for Mombasa, and thence conducted an expedition of two hundred and thirty men inland, to Kibwezi, where he founded the Scottish East Africa Mission, which they endowed. That was in October 1891, and amid no little hardship. Since that time the Uganda Railway has transformed the country, and the Scottish mission has been removed to the healthier region of Kikuyu, near Lake Victoria Nyanza. Again he returned to Lovedale, which, before he passed away in the seventy-fifth year of his age, he saw recognised by all Churches and by Lord Milner's Commission of the Six States on Native Affairs, as the chief college for the spiritual, industrial, and intellectual elevation of all varieties of the great Bantu race. Between them David Livingstone and James Stewart have, in the past sixty years, set in motion forces which are transforming Africa south of the Equator. Stewart died in the very crisis of the transition which the colleagues who helped him, the natives he trained, and the statesmen he influenced, are now working out. G. S.

GEOGRAPHICAL NOTES.

EUROPE.

The Flora of Scottish Lakes.—In connection with the numerous articles on the Botanical Survey of Scotland which have appeared in this *Magazine*, attention should be drawn to an article by Mr. George West (*Proceedings of the Royal Society of Edinburgh*, xxv. p. 967) on the plants of aquatic and semi-aquatic habit found in or about the lakes in the Loch Ness area, the lakes in the island of Lismore, and the lakes situated between Nairn and the Culbin Sandhills. The article is illustrated by a very fine series of photographs of characteristic lake plants and of lake scenery, and forms a notable contribution to the subject.

Subterranean Rivers and Lakes in Spain.—*In the Boletin de la Real Sociedad Geográfica*, xlviii., in the course of a retrospect of geographical progress during 1904 reference is made to the whole problem of the circulation of underground waters in Spain. On the northern slopes of the Pyrenees a considerable amount of work on caves has been done by M. Lucien Briet and M. Martel, but in Spain itself much remains to be done, especially from the economic standpoint. Thus the drainage of the snow-cap of the Maladetta disappears entirely and reappears later from the fissure of the Toro. This constitutes the problem of the sources of the Garonne which M. Belloc was quite unable to fathom. In Valencia a Spanish engineer is meditating the sinking of what he calls semi-artesian wells in order to tap the subterranean lake all along the coast. As water is a valuable commodity in Spain generally, a knowledge of the course of the underground water is important both from the economic and scientific standpoint.

ASIA.

The Kangra Earthquake.—In the *Records of the Geological Survey of India*, xxxii. 4, Mr. C. S. Middlemiss gives a preliminary account of the great earthquake of April 4, 1905. In its destructiveness this earthquake is only comparable to that of 1897, which was more extensive and violent, but did not give rise to such a heavy death-roll. The 1905 earthquake was characterised first by its suddenness, the preliminary tremors being very brief. There were two areas of violent shock, one in the Kangra-Kulu area which was the more violent, and one in the Mussoorie area. The geological map shows that both of these regions lie in embayments on the course of the great boundary fault of the Himalayas. Generally, the Tertiary foundations of the sub-Himalayas form an even line, but in the two regions mentioned they sweep inwards towards the old Himalayan rocks in great curves. Now, as in Tertiary, post-Tertiary, and recent times, the tendency has been to smooth out such irregularities, it is probable that the areas which retain irregularities are in a state of strain, particularly favourable to earth movements.

Another source of strain is the steep slope from the Kangra valley at about 3500 feet to the Dhauladhar ridge at about 16,000 feet, a horizontal distance of only six miles. This must lead to denudation involving a change of load in the two areas. Somewhat similar conditions exist in the Mussoorie area.

The earthquake was felt over an area of 1,625,000 square miles, but the isoseismal corresponding to 10 degrees on the Rossi-Forel scale includes an area of only about 200 square miles, while that corresponding to eight degrees includes an area of about 1600 square miles. Within the first area practically all buildings were destroyed, and within the second about half.

Africa.

From the Tuat to the Niger.—M. E. F. Gautier, in *La Géographie* for January 15, gives an account of a journey undertaken by himself last summer from Taurirt in the oasis of Tuat to Gao on the Niger. The following are among the more striking of the scientific results obtained. A large number of the great tombs which abound in the Sahara were excavated, and many prehistoric weapons and implements collected. As the result of these excavations, the author has come to the conclusion that a Neolithic Soudanese civilisation extended far over the Sahara almost to the borders of Algeria. Upon the traces of this early civilisation relics of the Berber invasion are superimposed. A study of the former circulation of water in the Sahara leads M. Gautier to believe that the existing sharp bend ("elbow") on the course of the Niger is the result of recent river-capture. Formerly, he believes, the upper waters of the Niger had a north to south direction, and the abandoned course, like the Wadi Saura, the Wadi Botha, and the wadis coming from the Tafilet and the Hoggar, all converge towards the same point, the salt-pans of Taudeni. He believes that this great system of streams, now completely dead, retained a measure of life up till a recent period, perhaps even to the Roman period, and that around it there existed a Sudanese civilisation agricultural in type. The northward progression of the desert, which overwhelmed the streams, overthrew this civilisation. From his investigations on the northern bank of the Niger the author formed the opinion that in the Quaternary epoch the Sahara occupied the site of the present Sudan, and has gradually travelled northwards, the so-called laterite of the Sudan being the remnant of Quaternary sand-dunes.

As regards the Sahara generally, M. Gautier remarks that as an obstacle to free communication it is less formidable than has been supposed, but he appears to regard the hope of economic development as a chimera. The only part which has hope of advance is that along the bend of the Niger, which is meantime suffering from the domination of a migratory pastoral people, unfitted to make the best use of its resources.

Expedition to Central Africa.—It is announced that the Duke of the Abruzzi intends to set out for Central Africa from Naples

on April 16, with eleven companions, among whom are Captain Cagni and Signor Vittorio Sella. The immediate object is stated to be the ascent of Ruwenzori. This mountain has been recently ascended by Dr. Grauer, an Austrian. Dr. Grauer's ascent was made on January 18 with two companions, and the party ascended to the summit of the small peak, but the highest point has not apparently been conquered yet.

America.

Recent Change in Level in Alaska.—Messrs. Tarr and Martin have an interesting note under this heading in *Science* for Dec. 29. About the middle of September 1899, a series of vigorous earthquake shocks was reported on the coast of Alaska, in the St. Elias-Fairweather region, and the Geological Survey party in this region has collected evidence to show that the earthquakes were associated with profound disturbances of the shores of Yakutat Bay and its extensions, called Disenchantment Bay and Russell Fiord. The evidence is threefold—(1) physiographical, the elevation of sea-caves, beaches, and so forth; (2) biological, the finding of marine animals and plants attached to rock surfaces now above water-line, and bearing land-plants, which, however, do not exceed five years in age; finally (3) there is the evidence of the natives of the region. There is also evidence of depression in the region shown by the sea encroaching upon forest land. The authors describe the topography of the region, and conclude that the earthquake was the result of a great upward movement along the front of the St. Elias chain, with minor differential movements of varying significance, which together completely fractured the crust along and near the shores of the fiord. Along the extreme front of the mountains which face the fiord the uplift was from six to nine feet, but further back it reached a much greater figure, reaching in one place a maximum of forty-seven feet. It is of interest to note that long ago Professor Russell assigned a fault origin to the peculiarly steep and straight mountain front in this region, and there is distinct evidence of an earlier, but still very recent, movement along this major fault line.

Polar.

The Greenland Biological Station.—We have already noted here (xxi. p. 105, and p. 274) the proposal to found a station on the island of Disko, for purposes of scientific research, and we have now to record the receipt of a letter from Mr. Porsild, giving further information as follows :—

"In the summer of the present year a permanent station for the study of Arctic science will be established on the south coast of Disko Island in Danish West Greenland. The cost of the foundation is defrayed by a gift from Mr. A. Holck, Counsellor of Justice, of Copenhagen, and the Danish Government has promised an annual grant of kroner 10,000 (£600) towards its maintenance.

"A laboratory, equipped with appliances and instruments especially for biological research, will be attached to the station, and work-places will be furnished for visiting naturalists, foreign as well as Danish. The establishment of

two such places is contemplated at present. Visitors will obtain the free use of the instruments, travelling outfit, and library of the station. Lodging will be free, and a small fee will be charged only for board. Cheap fares to and from the station *via* Copenhagen will be provided. The first visitors can be received in 1907, and notices inviting application will be issued in due course."

We are also requested to state that as it is intended to establish a library in connection with the station, gifts of books or papers dealing with the Arctic or Antarctic, and especially works on Arctic Biology, will be gratefully received. At present communications should be addressed to Professor Morten P. Porsild, Copenhagen.

General.

Insects and Disease Distribution.—In *Nature* for January 4 there is reproduced a lecture delivered by Mr. A. E. Shipley before the British Association in South Africa, which gives a most picturesque account of modern investigations in regard to the distribution of disease by insects. Africa, as Mr. Shipley points out, has from prehistoric times offered many attractions to the adventurer, and yet century after century it has been kept largely free from immigrants, save just at the fringes. Why? The geographer could give doubtless many reasons, but one and not the least important is that three insignificant kinds of flies keep watch and ward over the interior. The gnat Culex which carries the germs of the disease filariasis, Anopheles which carries malaria, Glossinia which carries fly disease to cattle and horses and sleeping sickness to man, these, in the words which Mr. Shipley applies to one of them, "have changed the face of continents and profoundly affected the fate of nations." Looking at what these three genera have done, it is not difficult, says Mr. Shipley, to understand why Beelzebub was called the Lord of Flies.

Geographical Congress at Marseilles.—We have received a communication to the effect that a *Congrès de l'Alliance Française et des Sociétés de Géographie* will be held at Marseilles in the middle of next September, under the presidency of Mr. J. Charles Roux, President of the *Union Coloniale*. The congress is to be held at the National Colonial Exhibition at Marseilles, which is open from April 15 to November 15 of the present year, and membership, which is open to ladies, confers the privilege of entrance to the Exhibition during the meetings of the Congress. Application should be made to the General Secretary, M. Jacques Léotard, rue Montgrand, 21, Marseilles.

The Meeting of the British Association.—Some further details have come to hand as to the 1906 meeting of the British Association, which is to be held at York. The Meeting will begin on August 1, and it is announced that the President of Section E (Geography) will be Sir George Taubman Goldie, Dr. J. Scott Keltie and Major Close being Vice-Presidents.

The Teaching of Geography.—At a meeting of the University Court of Aberdeen held on March 13, the Court, approving of a report by the Senatus, resolved to intimate to the Council of the Glasgow and West of Scotland Branch of the Teachers' Guild (cf. this *Magazine*, p. 109) that, in their opinion, geography deserves fuller recognition as a subject of study than it at present receives, and that they would cordially welcome any practical steps that may be suggested for carrying this into effect.

NEW BOOKS.

EUROPE.

Old Maps and Map-Makers of Scotland. By JOHN E. SHEARER, F.S.A.Scot., F.R.S.G.S. Pp. 86. Maps and Illustrations. Stirling: R. S. Shearer and Son, 1905. *Price* 10*s.*

The *Scottish Geographical Magazine* was much indebted to Mr. Shearer for his very interesting articles on "The Evolution of the Map of Scotland." These articles he has further elaborated and published, with additional illustrations, in the present attractive quarto.

Considering that, with the exception of Mr. Bartholomew's Chronological Sketch of Scottish Cartography in the Society's *Atlas of Scotland*, this is practically the first attempt at a general review of the subject, it is most creditable to Mr. Shearer's research that he has done the work so adequately. Until comparatively recent times the cartography of Scotland was not a national undertaking, but very much at the mercy of foreign map-makers; nevertheless it is gratifying to know that Timothy Pont and Robert Gordon of Straloch did work which Scotland may well be proud of. Mr. Shearer's plea for the formation of a National Historical Collection of Scottish Maps deserves the special consideration of the Scottish Geographical Society, and no doubt, if the Society's members would only co-operate and contribute, this much-desired object would soon be realised. Mr. Shearer has already been instrumental in publishing facsimiles of many of the old maps of Scotland, and this descriptive bibliographical work is another important contribution to the subject which should be much appreciated by every one interested in the early history of Scotland.

La Colonisation et les Colonies Allemandes. Par ANDRÉ CHÉREADAME. Paris: Librairie Plon, Plon-Nourrit et Cie., 1905. *Prix* 12 *frcs.*

M. André Chéreadame, the writer of the thoughtful and interesting volume now before us, is well known, at least in his own country, as an authority on Austria, and the many problems which the mere mention of that country at once brings to mind. In this work, however, he deals with another subject, viz. German colonisation and colonies; he sketches the comparatively recent history of the movement in favour of colonisation on the other side of the Rhine, and he gives a brief historical, statistical, and economic account of each of the German colonies now in existence. From a prefatory note we learn it is some seven years since he began this work, the completion of which was delayed by a number of unavoidable causes. The history of recent German colonisation divides

itself naturally into two periods, the point of division being the dismissal of Prince Bismarck by the present Emperor. It is true that in the seventeenth century the Grand Elector, fired by the example and success of England, France, and Holland in colonisation, made what may fairly be called an attempt to enter into competition with them both in the East Indies and on the West Coast of Africa. But although keen and enthusiastic and far-seeing himself, he was not supported by his subjects at home, and after his death in 1688 none of his successors took any real interest in colonisation. In 1717 Frederick-William I. sold the factories on the West Coast of Africa, which he held in but precarious possession, and for a long time Germany, or rather Prussia, had no colonies. Accounting for this, M. Chéreadame says, "un peuple pour coloniser, doit être arrivé à sa pleine croissance, il doit être adulte; il doit être sorti du long et pénible travail de gestation par lequel se forme un État, une nation; cet État doit être *un*, c'est-à-dire avoir réalisé, sur son propre territoire, son unité territoriale et politique. Sûr de lui-même, et n'ayant plus à redouter les profondes commotions qui pourraient modifier sa structure, il tendra alors, tout naturellement, lorsqu'il sera assez fort et assez riche, à pratiquer l'expansion dans les contrées lointaines. La tentative du Grand Electeur fut donc prématurée, et, dès son origine, condamnée."

But it was otherwise in the nineteenth century, one of the most noteworthy movements of which was the rise, progress, and realisation of the idea of an United Germany. Before the year 1870, however, several causes had been at work, which taken together had revived the conception of German colonisation. Some of these were the example and success of adjoining nations, the wholesale emigration from Germany itself, the general feeling that if Germany was to continue one of the first-class powers of Europe, it must have the means of developing itself outside its European borders, the writings of List and Friedel, and German savants such as Ziegler, Rohlfs, Ackerman, Barth, Bastian, Manch, Bruesch, Owerweg, Nachtigal, and many others, a brilliant roll of travellers and explorers of whom any nation may well be proud. The great majority of these travellers had devoted their energies to Africa; and as, with the exception of China, most of the available tracts of Asia were already in the hands of France or England, it was to Africa that Germans in favour of colonisation turned their attention. There was also another exceedingly good reason for this choice. At that time Prince Bismarck was all-powerful at Berlin, and his avowed policy was to strengthen as much as possible the Empire at home, and resolutely to oppose any measures which might tend to draw it into hostility or even complications with powerful nations across the sea. In fact, Prince Bismarck fully realised that Germany had then no fleet. But time and facts were too strong even for the Iron Chancellor. The travellers, explorers, and economists, who advocated a forward colonial policy, were joined by the merchants and the captains of industry in the great towns, and they never tired of pointing to the colonial successes of other nations, and the necessity of providing more outlets and markets for their own productions. The number of emigrants—210,000 in one year, *i.e.* 1881—attracted attention, and a natural regret was felt that other countries, notably America, should absorb such a large number of useful citizens, because, as a matter of fact, there were no German colonies to which they could go. The military party clamoured also for coaling stations for the fleet which was in the course of being built. Under such pressure Prince Bismarck had to modify his policy if not his views, and he took under the protection of the State the lands belonging to mercantile houses which had been founded in Africa and elsewhere; although in doing so he recorded his protest against the system, and announced

his firm intention to limit the action of government simply to the protection of the colonists from unjust attacks at the hands of their neighbours. But again time and facts were too strong for him, and, in the words of M. Chéreadame, he lived to see the colonial policy, which seemed to him so hateful and dangerous to German supremacy, become on his retiral from politics the principal subject-matter of diplomacy. After the fall of the Chancellor the administration of the colonies was formally undertaken by the young Emperor himself, and remains in his hands up to the present day.

Omitting as quite exceptional the fortification of Kiao-chao, taken *on lease* for ninety-nine years from China in 1898, the colonies of Germany are situated in Africa and in the Pacific Ocean. Those in the Pacific are quite inconsiderable as colonies—their commerce is trifling, and they cost the Empire much more than they return to it in any shape or form. In Africa, however, both on the East and South-West, Germany has considerable territories, but whether they are of much value as colonies is a very different question. It will be admitted by all that if the acquisition of these territories was intended to be an expansion of the Empire with a view to divert emigration from America, etc., then they have signally failed to do so; and in all probability, owing to climatic conditions, they never will nor ever can attract emigrants. In German East Africa the white population in 1903 was only 1237, of whom 377 were officials, 293 missionaries, and only 138 merchants and 91 planters. In South-West Africa there were only 4682 of a white population, of whom 939 were officials and military, 54 clericals, 277 commercials, 813 colonists, and 693 workmen. The greater part of this book is taken up with a somewhat dry statistical account of each of the German settlements under such heads as geographical position, boundaries, climate, administrative divisions, law, education, missions, finance, roads, railways, imports, exports, etc. The figures given are for the year 1902-3, and so are to some extent obsolete, more especially with regard to the territories in South-West Africa, where the Herero rebellion has introduced complications, and caused troubles which even yet cannot be said to have been settled. The radical and unfortunately incurable misfortune of the German colonies is, on the one hand, their climate, in which Europeans cannot live, and, on the other, the geographical position, where there is but little trade to develop. M. Chéreadame puts the matter in a nut-shell when he says, "la question vraie, la réalité, est de savoir si le gouvernement de Berlin se résignera à constater les échecs coloniaux et s'il ne cherchera pas à se procurer les terres d'outre-mer qui lui manquent aux dépens d'autres puissances qui en possèdent à la convenance allemande." M. Chéreadame goes on to say, "Or, *seules l'Angleterre et surtout la France* ont des colonies correspondant bien aux besoins allemands."

We may conclude these remarks with a hearty recommendation to our readers to peruse this thoughtful and instructive work for themselves.

ASIA.

Village, Town, and Jungle Life in India. With Illustrations. By A. C. Newcombe. Pp. x + 417. *Price* 12*s.* 6*d. net.* Edinburgh and London: William Blackwood and Sons. 1905.

The author of this book gives us to understand that he served in the Department of Public Works under the Government of India from 1874 to 1902. He apparently spent the earlier portion of his service in the Irrigation Branch of the Department, the latter portion in the Railway Branch; and he was attached to various of the subordinate Provincial Administrations, from the Panjab and Scind

to Assam and Bengal in the north, to Madras and Haidarabad in the south. He thus saw and took part in Anglo-Indian life, and came into close contact with the natives in various regions of India, both in the hills and in the plains. The book is a series of sketches, more or less consecutive, of the author's reminiscences and observations during his career. It is not a learned treatise on the peoples of India and their manners and customs. It is such a book—of a popular, somewhat superficial, sort—as a retired official, who was not a specialist in any of the many fields that lie open in India to the student and scientific man, but who was glad to occupy pleasantly some of the leisure of his retirement, might be expected to compile from a fairly well-kept diary of his past life. The accuracy of some of its statistical, historical, and natural history information might possibly be questioned, and some of the incidents described may seem trivial. But on the whole the class of reader for which the book is designed—the prospective visitor to India and his friends—will find it a reliable enough representation of the everyday life and surroundings which the average British resident may expect to experience. The narrative, moreover, is frequently highly realistic, and its naïve garrulity often extremely entertaining.

AFRICA.

New Egypt. By A. B. de Guerville. Pp. 360 + xiv. London: William Heinemann, 1905.

Mr. De Guerville went to Egypt to write a book, he says in the introduction, and this honest admission of the author's aim and intention will no doubt give the reader a hint of what kind of a book to expect. The author travelled from Alexandria to Fashoda in a leisurely and comfortable way, and visited the celebrities, from the Khedive downwards, taking ample notes of all they told him and of everything he saw for himself. He does not profess to go deeply into the Egyptian question, but what he says shows that he has taken a sensible and sound view of the situation, and the compliments he pays to the British administration come with the best of grace from the pen of a brilliant French writer, and will be duly appreciated by readers on this side of the silver streak. Interesting notices are given of the prominent statesmen and characters in the drama of New Egypt, and a whole chapter is devoted to the Khedive, Abbas Hilmi. "At first he refused the hand of friendship which had been held out to him, for he desired before giving his confidence to the English to see them at work, so that relations at that time were cold, official, and distant. With extraordinary determination and energy he set himself to study the needs of the country; and, little by little, the knowledge dawned on him that England was keeping her word, and was working sincerely and honestly for the good of Egypt.

"Then, and only then, was peace made, and the year which saw the *rapprochement* between England and France also saw his Highness paying a friendly visit to King Edward, *fêted* and petted by London" (p. 109). The author relates sundry anecdotes from more or less authentic sources, some of which would have perhaps been better left out in a book intended for English readers. Dragomen are not the most reliable of authorities, and their numerous tales are scarcely worth repetition in print. One or two of the author's friends' statements should have been scrutinised a little before publication. At page 230, for example, we read that a celebrated archæologist told him that the English engineers "chose the actual site [of the dam] because the bed of the Nile at that point is rocky; but the Assouan rock is hard only on the surface, this hardness coming from the action of the water; underneath it is soft—in a way rotten. For two years, under the

continual pressure, the rock on which the foundations rest has sunk, and the dam itself has already shifted about eight feet. My opinion is that it will not last. . . ." This is a serious statement to publish when it is recalled that the original Cairo Barrage built by French engineers was condemned as useless for many years because part of it moved only *eight inches* when the weight of water, far less than that at Assuan, pressed upon it. Had the great dam moved as much as eight feet, the world would surely have heard of it long ago. The truth seems to be that it is the rock surface *downstream* that is being eroded away by the volume of silt-laden water spouting out of the sluices, and not the rock *perpendicularly* under the structure, as the author is led to believe by his archæological friend, who is clearly unqualified to give an opinion worth publication on such a subject.

The book is lightly written and easily read, and is illustrated by about one hundred and seventy admirable photographs.

AMERICA.

Through Five Republics. By PERCY F. MARTIN, F.R.G.S. London: William Heinemann, 1905.

In this work Mr. Martin proposes to give us "a critical description of Argentina, Brazil, Chile, Uruguay, and Venezuela in 1905." Now these five republics have between them an area of more than five and a half millions of square miles and a population of something like twenty-six millions, so the task which Mr. Martin set before himself was no light one. We gather, however, from a sentence in the preface that three years is the period which he has been able to devote to their study, and considering the magnitude of the subject, it will be readily admitted the period is none too long. Mr. Martin tells us he is a journalist by profession, and even had he not done so, the fact would have been abundantly clear from internal evidence of this book. At places it is most unmercifully, and we may add most injudiciously, padded with details which are of no interest to the ordinary reader, although they are often an excellent advertisement for certain industrial concerns at home. For example, in a description of a visit to the Central Uruguay Company's workshops at Peñarol we have more than a whole page of details like these:—1 wheel lathe for wheels up to six feet diameter—makers, So-and-So; 1 wheel lathe—makers, So-and-so, another firm . . . 1 small turret lathe by So-and-so, a third firm; 1 small capstan chasing lathe by So-and-so, a fourth firm; 1 No. 3 Hexagon chasing lathe by So-and-so, a fifth firm; and so on, as we have remarked, for more than a page.

Again, in commenting on the insurance laws of the Argentine Republic, Mr. Martin gives a list of nearly all the insurance offices of the world which have offices in Argentina, with details of the various taxes levied on each class of company, and even of the stamps payable on the policies. In a work purporting to be a critical description of certain republics, we do not expect to find details of the charges made by various hotels, with suggestions as to choice of rooms, remarks on the cuisine, appearance, costume, and manners of the waiters, condition of the cruets and crockery, etc. But passing by these blemishes, we go on to say that there is much that is interesting in the book, although there is little that can be called new. Mr. Martin sets forth in vigorous and unsparing language the financial ways of the Governments of Brazil, Uruguay, and Venezuela, but it is to be hoped that by this time British capitalists have had enough experience of South American finance and are not likely to plunge in that direction any more. Judging from the space which he devotes to the subject, it would seem that

Mr. Martin was much interested in the railway systems of the South American republics, and those of our readers who share this interest could not do better than peruse what he has to say regarding the past history, present condition, and future prospects of these railways; but they must be prepared for an amount of details such as is most usually relegated to a technical report for the consideration of experts or directors. Mr. Martin is enthusiastic in his praise of Santiago-de-Chile, and coming from one who has resided for a time in almost every capital in the world, the eulogium is worth notice. He was delighted with the climate, the scenery, and the people, and with the freedom, cordiality, and sociability he found there, which were in marked contrast to much of his experience elsewhere. Even now there is in Santiago an absence of noise which distinguishes it from most large towns; the whole city, however, we are told, is being paved with asphalt, and on the completion of this work it will, so far as noise is concerned, rank next to Venice. Summing up his reflections on what he saw, Mr. Martin says: "If I am asked to what principal conclusion my experiences in the 'Five Republics' have led me, I would say the conviction that the gradual growth of British influence in South America should spell their regeneration. Underlying the petty native jealousies and the not infrequent outbursts of spiteful criticism levelled against British interests, there exists in the different States of South America the knowledge that British brains, British money, and British *esprit de corps* have loomed largely in the building up of these countries, while, to use the expression of a sympathetic Spanish newspaper published in the Argentine, and not usually given to praise of its foreign residents, 'this great civilising power has left upon us a deep and lasting impression, clearly recognisable.' This is only the truth, but it is something to have secured admission from such an unusual quarter. Our language and our literature are spreading throughout the South American Republics day by day. . . . Our capital and our trade have brought about this magic influence, and upon their continuance and expansion it must for ever depend." But he proceeds to point out that we are not utilising as we should the services of the able consular officials who are already in these republics—a state of affairs which he attributes to the indifference of the Foreign Office, with which he favourably compares the energy and enterprise of the United States Government. The work has three useful maps, the production of Stanford's Geographical Establishment, and is embellished with a large number of photographs.

In the Heart of the Canadian Rockies. By James Outram. New York: The Macmillan Company. London: Macmillan and Co., Limited, 1905.

At the beginning of this work the author has substituted an apology for a preface, from which we learn that in the preparation of this work he has utilised several articles which have already appeared in various magazines, and has quoted freely from the well-known works of Stutfield, and Collie, and Wilcox. The object of the book is to make a record of the "first ascents" of the principal Canadian Rockies; and we may at once remark that in one respect the author's qualifications for such a work are very exceptional. The Canadian Rocky range, as is well known, has none of the giant peaks which are found in the Alps, the Andes, and the Himalayas. The highest known among them is Mount Robson, the height of which is estimated to be only about 13,500 feet above the level of the sea; no one up to the present day has ever reached its summit. Next to it, however, comes Mount Columbia with a height of 12,500 feet, and the author of this book was the first to ascend it (July 1902)—a notable feat, for he had

with him only one guide. In all, some forty of the peaks of the Rockies above 10,000 feet in height have been ascended by mountaineers of all nations, and of these "first ascents" no less than twenty are to be credited to the Rev. Mr. Outram. His qualification in the important matter of experience, then, will be readily admitted. When we turn to the literary merits of the work, we find them also everything that is to be desired. Mr. Outram writes with modest restraint about his own performances, but he is eloquent and enthusiastic regarding the good work done by his fellow climbers, and especially by the brave and skilful Swiss guides who accompanied him. He has a keen eye for the picturesque, and is able to give us a charming work-picture of the marvellous and majestic scenery among which he wandered. His narratives are often intensely thrilling, but they never seem overstated. The illustrations of this work are exceptionally good. Those of our readers who saw the photographs which illustrated Mr. W. Douglas's lecture on Mount Assiniboine in January 1904, will know what to expect, and they will not be disappointed. The illustrations alone will secure for this work a great number of readers outside the circle of those who are interested merely in mountaineering.

AUSTRALASIA.

The World of To-day: Vol. IV., Oceania. By A. R. Hope-Moncrieff. London: Gresham Publishing Company, 1905.

We lately reviewed volume iii. of this series dealing with Africa, and the praise then accorded to Mr. Moncrieff's work must be bestowed as fully on this later volume. It is a varied field which it covers—French Madagascar, our own Australian Continent, New Zealand, in its character still more our own, the multitudinous islands of Oceania, and finally the Antarctic Ocean. The writing is of unfailing interest, and is, moreover, thoroughly up to date and in touch with its subject. In the appendix are collected many valuable statistics about Australasia, and we regret to note that the town population of the Australian Commonwealth forms thirty-five per cent. of the whole. A useful statement of public income, expenditure, and debt is included; the latter greater per head in New Zealand even than it is in Australia. Of the many native beauties who are depicted, we have no hesitation in giving the palm to the Maori lady.

POLAR.

The Norwegian North Polar Expedition, 1893-1896. *Scientific Results*, edited by Fridtjof Nansen. Vol. vi. Pp. 659. 20 Plates. London: Longmans, Green and Co., 1905.

This handsome quarto volume is entirely devoted to Meteorology, the observations being made during the three years' drift of the *Fram*, and by Nansen on his sledge journeys. Meteorologists will feel grateful to Professor H. Mohn, under whose direction the observations have been prepared for publication, and who discusses the results. Only those who are personally familiar with the involved and tedious processes required for an adequate discussion of meteorological observations can appreciate the enormous amount of labour involved in the preparation of the 225 pages of observations and in the 400 pages devoted to the results. Professor Mohn has, however, done more than this, for in the preparation of the circumpolar charts of pressure, temperature, etc., he has utilised the data of all previous polar expeditions, and thus contributed a substantial addition to our knowledge of the meteorology of those regions which will remain a standard of reference for many years to come.

Professor Mohn points out that during the whole time the observations were taken on a level surface of frozen water with a perfectly clear horizon, so that the data are perfectly homogeneous throughout.

Owing to the great distance between the *Fram* and any other meteorological station, it was impossible to construct daily synoptic charts to elucidate the movements of cyclonic and anticyclonic systems, but by differential methods the bearings of low-pressure systems and their motion has been ascertained. In three years the *Fram* came within the influence of seventy-three low-pressure systems. These were most frequent in January, while the least number were recorded in June. The highest barometric pressure observed was 30·382 inches, and the lowest 28·508 inches, showing an extreme range of 1·874 inch. Unlike the South Polar Regions, the winds were not of much strength, the highest velocity registered being only forty miles per hour, while the average of the whole drift was at the rate of ten miles per hour.

The chart of isotherms shows that the mean polar temperature ranges from – 40° F. in January and February to 32° F. in July. The isabnormal lines show that the warmer region is located on the Atlantic side, while the colder region is located near Bering Strait, Eastern Siberia, and Alaska. Professor Mohn gives an elaborate analysis of the diurnal periods of all the climatic elements, and shows that the main factor at work is the heat received by radiation from the sun, this influence being apparent even during the long polar night.

GENERAL.

Hints to Meteorological Observers. By W. Merriott, F.R.Met.Soc. Prepared under the direction of the Council of the Royal Meteorological Society. Sixth Edition, revised and enlarged. London: Edward Stanford, 1906. *Price* 1*s.* 6*d.*

A previous issue of this useful little handbook was reviewed in vol. xiii. (1897) p. 504. The present edition is considerably larger, over twenty new pages having been added, together with a number of new figures of apparatus. Among the additions are a glossary, some very useful new tables, and a short list of books and publications relating to meteorology. In the last-named we notice with some surprise the omission of the *Journal of the Scottish Meteorological Society.* It can hardly be supposed that an interest in meteorology is confined to the southern portion of Great Britain.

The Underwood and Underwood System of Visual Instruction. Physical Geography for Schools. Set A. London and New York: Underwood and Underwood.

We have received a set of three dozen stereographs from Messrs. Underwood illustrating physical geography, together with a detailed explanation of the photographs, a stereoscope, and various pamphlets, etc., discussing the educational value of the stereoscope in the teaching of geography.

Practically all teachers are now convinced of the value of lantern slides in teaching, but these have nevertheless several great disadvantages. The necessary darkening of the room is often troublesome, and always increases the difficulty of discipline in the case of large classes; the inevitable "flatness" of the ordinary photograph deprives the objects depicted to a large extent of their actuality in the eyes of children and untrained persons, and this is accentuated by the fact that the objects are not usually represented in their natural size. All these difficulties vanish when the stereoscope is substituted for the lantern, and we are much impressed by the value of Messrs. Underwood's productions. The stereo-

scope supplied is a light and handy instrument, and the intention is that each member of the class should be supplied with one, as well as with copies of the stereographs. In photographs intended for teaching purposes, it is essential that the picture should clearly show the points which it is intended to illustrate, and that there should be as little extraneous matter as possible, for this soon distracts the attention of the class. On the whole, the examples sent fulfil this condition admirably, and we have been specially impressed with some of the views of glacial phenomena. It is not at all easy to give an adequate conception of the meaning of terms such as glacier, crevasse, and moraine to those to whom glaciers are unknown, and the stereoscopic effect is here of great value. But, indeed, the stereographs generally are instructive and not merely pretty or interesting, as such productions are sometimes apt to be.

The stereoscope and the views have been placed on the table in the Library for inspection by members and others interested.

ANNUALS.

The Year-book of the Scientific and Learned Societies of Great Britain and Ireland. Compiled from Official Sources. London: Charles Griffin and Co., 1905. *Price 7s. 6d.*

This is the twenty-second annual issue of this useful year-book, which gives a clear and concise account of the scientific work now being done in our country under the auspices of the learned societies and other institutions, and is invaluable for reference.

Hazell's Annual for 1906. *A Cyclopædic Record of Men and Topics of the Day.* Revised to December 2, 1905. Edited by W. Palmer, B.A. (Lond.). London: Hazell, Watson, and Viney, Limited. 1906.

This *Annual*, as usual, appeared promptly, and in addition to the customary features, has in the present issue a number of biographies of foreigners of importance as well as the full text of such important documents as the Russo-Japanese Peace Treaty. Under the heading of scientific progress we have as usual some very good short summaries, though we cannot but regret that the editor does not give a date for the closing of the record apart from that on the title-page. It is obviously impossible that all articles should be left to the last moment, and it would in our opinion be better if the summaries had been dated 1904-5, and definitely and frankly closed in the autumn of 1905. For example, under geographical progress, we notice that, though the start of the Duke of Orleans' expedition is noted, the return, which occurred on September 12, is not recorded. Again, in the review of the work of the French Antarctic Expedition, the statement is made that "the connection of Bismarck Strait with the east coast of Graham Land was proved." This was the first deduction made from Dr. Charcot's cable, but proved to be erroneous when fuller data were available (cf. our issue of last September, p. 464). The summary of *Geographical Progress* is, on the whole, so good and so useful that it is impossible to avoid wishing for the further improvement suggested above.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Granada: Memories, Adventures, Studies and Impressions. By Leonard Williams. Demy 8vo. Pp. 213. *Price 7s. 6d. net.* London: Heinemann, 1906.

Calcutta Past and Present. By KATHLEEN BLECHYNDEN. Crown 8vo. Pp. xvi + 245. *Price* 7*s. net.* London: Thacker, 1906.

In the Land of the Gods: Some Stories of Japan. By ALICE MABEL BACON. Crown 8vo. *Price* 5*s. net.* Pp. xii + 273. London: Constable, 1906.

The Harmsworth Encyclopædia. Volumes IV. and V. Edinburgh: Nelson and Sons, Ltd., 1906.

Rambles in Brittany. By FRANCIS MILTOUN. Illustrations by BLANCHE M'MANUS. Crown 8vo. Pp. xiii + 376. *Price* 6*s. net.*

Rambles in Normandy. By FRANCIS MILTOUN. Illustrations by BLANCHE M'MANUS. Crown 8vo. Pp. xiii + 448. *Price* 6*s. net.* London: Duckworth and Co., 1905.

Hinterland Moï. Par PAUL PATTÉ. Pp. vii + 261. *Prix* 4 *francs.* Paris: Plon-Nourrit et Cie., 1906.

The Museums and Ruins of Rome: A Synthetic and Comprehensive View of the Art Collections and Buildings. By WALTHUR AMELUNG and HEINRICH HOLTZINGER. Vol. I. Pp. xxii + 326. Vol. II. Pp. xii + 183. *Price* 10*s. net.* London: Duckworth and Co., 1906.

A Complete Pronouncing Gazetteer or Geographical Dictionary of the World. Edited by ANGELO HEILPRIN and LOUIS HEILPRIN. Imperial 8vo. Pp. x + 2053. *Price* £2, 2*s. net.* London: J. B. Lippincott Company, 1906.

Benares, the Sacred City: Sketches of Hindu Life and Religion. By E. B. HAVELL, A.R.C.A. Large Demy 8vo. Pp. xiii + 226. *Price* 12*s.* 6*d. net.* London: Blackie and Son, Ltd., 1906.

Mittelmeerbilder: Gesammelte Abhandlungen zur Kunde der Mittelmeerländer. Von Dr. THEOBALD FISCHER. Pp. 480. *Preis* 6 *m.* Leipzig: B. G. Teubner, 1906.

Sociological Papers. Volume II. By FRANCIS GALTON, P. GEDDES, M. G. SADLER, E. WESTERMARCK, H. HOFDING, J. H. BRIDGES, and J. S. STUART-GLENNIE. Published for the Sociological Society. Royal 8vo. Pp. xv + 312. *Price* 10*s.* 6*d.* London: Macmillan and Co., 1906.

At the Gates of the East: A Book of Travel among Historic Wonderlands. By Lieut.-Col. J. P. BARRY, A.B., M.B. Demy 8vo. Pp. xx + 261. *Price* 6*s. net.* London: Longmans, Green and Co., 1906.

Also the following Reports, etc.:—

The Australasian Handbook: Shippers', Importers' and Professional Directory and Business Guide for 1906. Thirty-seventh year of Issue. Maps, Plans, etc. Pp. 684. *Price* 10*s.* 6*d. net.* London: Gordon and Gotch, 1906.

Mission Scientifique Congo-Nil. Par le Commandant CH. LEMAIRE. Pp. 53. Brussels: de L'Etat Indépendant du Congo, 1906.

General Report on the Operations of the Survey of India, administered under the Government of India, during 1903-4. Prepared under the direction of Colonel J. R. HOBDAY, I.A. Calcutta, 1905.

Report on the Administration of the Bombay Presidency for the Year 1904-5. Bombay, 1905.

Report on the Administration of the United Provinces of Agra and Oudh, 1904-5. Allahabad, 1906.

Administration Report of the Marine Survey of India for the Official Year 1904-5. Bombay, 1905.

District Gazetteer of Bengal. 15 vols. Calcutta, 1905.

Madras District Gazetteers. 3 vols. Madras, 1905.

District Gazetteer of the United Provinces of Agra and Oudh. By H. R. NEVILL, I.C.S. Volume XL. Allahabad, 1905.

Willing's Press Guide and Advertisers' Directory and Handbook, 1906. (Thirty-third year.) Demy 8vo. Pp. 461. *Price* 1*s.* London: James Willing, Jr., Ltd., 1906.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th December 1905:—One-inch Map (third edition), printed in colours and folded in cover, or flat in sheets. *Garrick.*—Sheet 8. *Glasgow.*—Sheet 30. Price, on paper 1s. 6d. each; mounted on linen 2s. each.

Six-inch and larger Scale Maps.—Six-inch Maps (Revised), quarter sheets, heliozincographed, with contours. Price 1s. each. *Elginshire.*—18 SE.; 22 NW.; (23 SW., 23 SE., and 27 NW.; 31 NW.; 22 NE.

Without contours. *Elginshire.*—30 SW.; (33 SW. and 33 SE.).

1 : 2500 Scale Maps (Revised), with Houses ruled, and with Areas. Price 3s. each. *Ross and Cromarty.*—Sheets LII. 12, 16; LIII. 7; LXIV. 8; LXXXVII. 10, 11, 15; LXXXIX. 16; XC. 5, 6 (7 and 8), 10; XCVIII. 3; C. 3, 5, 6, 7, 8 (10 and 14), 11, 12; CI. 1.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st January 1906:—Six-inch Maps (Revised), quarter sheets, heliozincographed, with contours. Price 1s. each. *Elginshire.*—8 NE.; 23 NE. *Nairnshire.*—1 SW.; (2A SW. and 2 NW.); 4 NW.; 7 NW., 7 SW., 7 SE.; 8 SW.

Without Contours. *Elginshire.*—20 SE.; 24 SW.; (28 NE. and 29 NW.).

Nairnshire.—10 NW., 10 NE., 10 SE.; 11 NE., 11 SW., 11 SE.; 13 NW., 13 SW.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Ross and Cromarty.*—Sheets LII. 4, 8; LIII. 6, 9, 10, 11, 13, 14; LXIV. 7, 11, 15; LXXVI. 3, 9, 10, 11, 13, 14; LXXXVII. 4, 7, 8, 9, 12, 16; LXXXVIII. 11, 12, 13, 14, 15, 16; LXXXIX. 6, 8, 10, 11, 12, 13, 14, 15; XC. 9, 13; XCVIII. 4; XCIX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15; C. 1, 2, 4; (C. 9, XCIX. 16, and C. 13).

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 28th February 1906:—Four miles to one inch.—Printed in colours and folded in cover, or flat in Sheets. Sheets 8, 12, 16. Price—on paper 1s.; mounted on linen 1s. 6d. each.

One-inch Map.—Third edition, engraved, in outline. Sheets 5, 21. Price 1s. 6d. each. Third edition; Printed in colours and folded in cover, or flat in Sheets. *Sanquhar.*—Sheet 15. Price—on paper 1s. 6d.; mounted on linen 2s.

Six-inch and larger Scale Maps.—Six-inch Maps (Revised), full sheets, engraved, without contours. *Ross and Cromarty.*—Sheets 3A, 5, 7, 13, 14, 19, 19A, 20, 21, 35, 45, 48. Price 2s. 6d. each.—Sheet (5A and 2B). Price 2s.

Quarter Sheets, heliozincographed, with contours (Price 1s. each). *Elginshire.*—2 SE.; 5 SW.; 8 NW.; 10 NW.; 15 SE.; 16 SE.; 18 NW. *Nairnshire.*—1 SE.; 2 SW.; 4 SE.; 5 NE.; 5 SW.; 8 NW., 8 SE.

Without Contours. *Elginshire.*—28 SE. *Nairnshire.*—12 NE., 12 SE.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Ross and Cromarty.*—Sheets LXIV. 12, 16; LXV. 2, 3, 4, 6, 9, 11, 14, 15, 16; LXXVI. 4, 8, 15, 15, 16; LXXVII. 2, 3, 4, 6, 7, 9, 11, 12, 13, 14, 15, 16; LXXVIII. 1, 4, 5, 9, 13, 14, 15; LXXIX. 1; LXXXVIII. 2, 5, 6, 7, 8, 10; LXXXIX. 2, 3, 4, 7; XC. 1.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th December 1905:—Six-inch Maps, full Sheets, uncoloured.—Price 6s. each. *Island of Skye* (*Inverness-shire*).—Sheet 45.

AFRICA.

AFRICA.—General Staff Map on Scale of 1 : 1,000,000, or about 16 miles to an inch. District sheets—86, Albert Nyanza; 115, Andara; 123, Angra Pequena. 1905. Price 2s. each.

Topographical Section, General Staff, London.

EAST AFRICAN PROTECTORATE.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheets 94-A, 94-B, 94-C, 94-D, 94-E, 94-F, 94-G, 94-H, 94-I, 94-J, 94-K, 94-L, 94-N, 94-O, 95-A. 1905. Price 1s. 6d. each.

GERMAN EAST AFRICA.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheet 94-M. Price 1s. 6d. 1905.

GOLD COAST.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheets 60-G, 60-H, 60-K, 60-L. Price 1s. 6d. each. 1905.

NORTHERN NIGERIA.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheets 63-A, 63-M. Price 1s. 6d. each. 1905.

Topographical Section, General Staff, London.

NEW ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—A new Series of Maps with descriptive text and diagrams showing Products, Imports, and Exports, Commercial Conditions and Economic Statistics of the Countries of the World. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.S.E., F.R.G.S., etc. Complete in 22 Parts, issued fortnightly. Part I. containing maps and text illustrating World's Wheat and Coffee-Growing Countries, with statistics of supply and demand. 1906. Price 6d. each part. *George Newnes, Limited, London.*

This is the first part of a new Commercial Atlas of the World on a more complete and extensive scale than has hitherto been attempted.

STIELER'S HAND-ATLAS.—Neue neunte Lieferungs-Ausgabe von ——. Lieferungen 31 und 32; Nr. 36, Die Britischen Inseln. Nr. 53, Balkanhalbinsel, Bl. 3. Nr. 54, Balkanhalbinsel, Bl. 4. Nr. 56, Nord-und Mittel-Asien. Price 60 Pfennig each part. *Justus Perthes, Gotha.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

BOTANICAL SURVEY OF SCOTLAND.

A General Map of the Highlands with a Sketch of the History and Methods.

By M. Hardy, D.Sc., University College, Dundee.

(With Maps [1] and Diagrams.)

The institution of the Geological Survey of Great Britain some seventy years ago may be said to have sprung out of the material needs of the day. For years, the want of a systematic mapping of the mineral resources of the country had made itself deeply felt. The Ordnance Survey had, indeed, encouraged the members of its staff to keep a record of what geological observations they could make. But it was only when H. T. de la Bêche, having worked for some time alone and at his own charges, brought under the notice of the authorities the importance of the work he had accomplished, and submitted to them the scientific methods he had evolved, that a practical start was made. He first received a commission to affix geological colours to some county maps; a step that was soon followed, thanks to the support of Lyell and others, by the official recognition of his work as a branch of the existing Topographical Survey. Ultimately, in 1835, the Geological Survey was made a separate department. This was the opening of an industrial era, in which the mining activities of the country assumed enormous proportions. Geology thus came to be of primary importance.

But the situation evolved rapidly. The natural and necessary balance between town and country was soon destroyed. Urban industries drew more and more upon rural capital and population, wearing the latter out at an increasing rate of speed. Consequently, the towns

[1] The coloured map illustrating this article has been unavoidably delayed, and will appear with the June issue.

attracted an ever larger supply of rural produce from outside in exchange for their exports. This automatic process resulted in incapacitating rural districts for competition in the produce market, thus forcing upon them emigration, and deteriorating and ultimately drying up the national sources of the supply of men, while more and more human waste product was accumulating in the cities. Meantime the land, starved of labour, could not but pass into the hands of the more moneyed classes, whose active interests were engaged elsewhere.

This state of affairs has come to a crisis. The problem is now : Is it desirable that an effort be made to repopulate rural districts and thus restore the proper balance of nature ?

If we assume, on social, national, and economic grounds, the desirability of the attempt at colonising the country, it remains to be seen under what conditions this becomes practicable. Certain it is that many difficulties of a social character lie in the path. But these are altogether outside our province. As far as economics are concerned, and, as we know, they may be made ultimately to overcome all social obstacles, the end of alluring capital and population back to the land can only be attained if rural occupations pay far more than they used to, and, with less labour, afford some reasonable prospect of a civilised life. In other words, agriculture has to be industrialised, in the sense of a thorough division and organisation of labour and transit, and a strict economy of energy, at once of man, the land, and appliances ; which can only be done scientifically. The highest return at a minimal cost and progressively so, through a complete adaptation of cultures and methods to local conditions, subject to the demand ; thus the problem may be briefly stated. Improved seeds and stock, methods and machinery, and fertilisers, can only produce this maximum effect on condition of thoroughly adjusting every part of the ground to its respective best use.

We have, indeed, both a survey of the soils and a meteorological service. But it must be confessed that the drift-maps, so far as they have been carried out, especially for Scotland, are mainly confined to the stratigraphical aspect of the question, while the network of meteorological stations is too loose for local climatic purposes. Besides, the biological and, therefore, agriculturally important resultant of climatic and soil agencies is best, nay solely, expressed in terms of the spontaneous vegetation. To work out the connection between the nature of the complex environment and the character of the spontaneous vegetation, thus enabling practical men to diagnose the former from the latter, is the applied side of the Botanical Survey.

Years ago the importance of that point was recognised by the Geological Survey, and a patient series of observations collected to that effect. This attempt, unfortunately, proved futile on account of unsatisfactory methods. But the interesting fact remains that, *even as the Geological Survey had budded out of the Ordnance Survey, so now a Botanical Survey was budding out of the Geological Survey.*

Meanwhile the same question had been taken up, on independent lines, by botanists, under the name of Botanical Geography. They had

evolved their own methods and carried them to the stage of practical application. In some countries the new line received encouragement and support not only from the highest botanical authorities, but also from universities and other public bodies. In Great Britain, however, private workers had to pursue their studies at their own charges, obtaining altogether but scanty recognition, except for small and tentative grants that were occasionally allowed them. Thus the Botanical Survey stands at the stage at which the Geological Survey was before 1832. Quite a dozen workers have now been in the field. Part of them, starting under the impulse of Professor Geddes, worked on and propagated the French methods, adapting them to local requirements. Others have taken up the American methods and standpoint. With a view to comparing their results, to unifying their *modus operandi* and nomenclature, to organising their work, and to co-operating under homogeneous conditions, thereby gaining advantages which they could not otherwise hope for, botanical geographers have recently met and formed *a committee for the study of the vegetation of Great Britain.*

As far as the present writer is concerned, his programme has been one of progressive analysis. He has endeavoured to give a first and general sketch of the relations of the Scottish vegetation to the environment, and to man. A previous and detailed study of different parts of the country had raised many problems, which he resolved first to broadly work out in the larger field of the whole of Scotland. The benefits accruing from a preliminary general survey may be summarised as follows: (1) The raising of as many questions as possible, in order to avoid overlooking, in further detailed studies, general problems of importance which may not always be clearly stated locally. (2) A comparison of the various aspects and modes of statement of these problems. (3) The formation of an approximate idea of the general power and modes of working of the various agencies at work. It is, in any case, the only way to acquire some general guiding and correlating data, and to avoid hastily building up particular cases. But it is obvious that the prosecution of a work on such a scale is beyond the power of the individual.

It is intended here to outline some of the general conclusions by way of commentary to the accompanying map. They are based on the consideration of plant associations, *i.e.* constant and organised congregations, in a definite environment, of systematically independent species, the biological forms of which, competing with or dependent on one another, find conditions particularly suited to their own requirements in the original or modified circumstances of the environment, truly for no other purpose than the exclusive benefit of each associate, yet ultimately resulting in the realisation of as large an amount of symphytic metabolism as the biogeic potential of the habitat permits.

The first stage in this new line of research has been the collection of lists of species, varieties, etc., associated in given habitats, the description of which was, as a rule, summarily dealt with. Indeed, in countries possessed of a rich flora, this systematic side of the question was encouraged by the fact that the division of biogeic labour is carried very far. Consequently, the slightest variations of environment usually find

a distinct group of species whose ecologic optimum corresponds to these particular conditions and are thus revealed, at first sight, by the simple specific enumeration of their population. But in this isolated and floristically very poor country, diverse habitats may be occupied by the same species, which hardiness and wide limits of pliability enable to assume very different forms and modes of living. In extreme cases we may find associations systematically identical, yet of a quite different ecological meaning. Thus the greater importance of other criterions of associations is forced upon our attention.

The present state of a plant-association may be considered from a static and from a dynamic standpoint. The static study includes the external statics describing the geographical and topographical distribution, and the physical conditions of the environment. The internal statics describes on the one hand the physiognomy, and, on the other, the floristic composition. External dynamics involves the reaction to, and action on the habitat, while internal dynamics analyses the mutual adjusting of the component elements in time and space, *i.e.* the internal adaptations.

Furthermore, the study of associations must be considered in time, or in evolution, answering to the following points: description of the alterations in the habitat, description of the changes of the association in aspect and specific composition; again, from a dynamic point of view, there should be a study of the causes and modes of evolution of the habitat and of the association in its physiognomic and specific aspects. This may be simply expressed in the following:—

- Study
  - Present
    - Static
      - External
        - Geographical (topographico-geographic criterion, Schrœter).
        - Topographical (external ecologic criterion, Schrœter).
      - Internal
        - Physiognomic (ecologico-physiognomic criterion, Schrœter-partim).
        - Systematic (historico-systematic criterion, Schrœter-partim).
    - Dynamic
      - External
        - Reaction to environment (ecologico-physiognomic criterion, Schr. partim.
        - Action on environment.
      - Internal — Organisation—Internal adaptation.
  - Evolutive
    - Static
      - External — Description of the evolution of the habitat.
      - Internal
        - Physiognomic.
        - Systematic (historico-systematic criterion, Schrœter-partim).
    - Dynamic
      - External — Causes and modes of evolution of the habitat.
      - Internal — Causes and modes of physiognomic and systematic changes.

Such a programme may appear ambitious. Yet it is the only way of getting Botanical Geography out of the narrow and uninteresting path it has taken by the exclusive method of statistical enumerations of plants.

From a phytogeographical standpoint, the Scottish Highlands form

the northern or Caledonian province of the North British region, which, as far as we know, should include the hills of Westmorland, Cumberland, and Northumberland. In this province, we may at once distinguish two main sections, separated by a line which runs in a general North-South direction, parallel to the Atlantic-German divide. The distinction between the two is based alike on topography, climate, vegetation, population, and economic potentialities.

A more abundant rainfall on the Atlantic section has so far accelerated the modelling of the West Highlands as to reduce the original upheaved peneplain to narrow ridges and peaks, while the Grampians are left at the stage of large blocks with but a rude carving as yet. The same agency is responsible for a well-marked and well-known difference in the vegetation. A constantly moist, mild and cloudy atmosphere with a fairly regular distribution of rainfall all the year round, and an abundant supply of ground water, form ideal conditions for the development of pastures. Indeed, in the West, we have to deal with an essentially pastoral landscape. According to local circumstances of gradient and drainage, of nature of soil and subsoil, of altitude and exposure, the numerous modalities of a complete series of pastures are displayed before us. They range from peat bogs and wet moors on bottom and terrace lands to the dry grass moors and the alpine deserts on the steeper and upper slopes and summits. The whole of this section is to a surprising degree bare of forests, not from any natural cause, but through the agency of man. That this work of destruction has been made easier by the fact that in the sub-alpine zone a species of forest tree thoroughly adapted to the climate was lacking, is, however, very likely. For the excess of rainfall and wind is not favourable to the Scots pine, the only native timber of importance for this zone, or to the larch, which has much the same ecologic requirements. Norway spruce, Silver fir, and the Douglas fir would, under proper management, be best suited to these western hills. In the lower parts, mixed deciduous forests are quite at home, although there remain but insignificant vestiges of their former splendour. Cereal cultivation is similarly discouraged by the excessive rainfall, and finds but little available ground along the raised beaches and on bottom lands. Thus, setting apart the question of forests, the West Highlands are fit for little else than pastoral industries. In course of time these have evolved into game-breeding. The population is extremely scattered and miserable. Villages are few and far between. The few remaining crofts are thinly dotted along the shores of inland and salt lochs. Hotels and occasional holiday resorts are the sole promising centres.

With their crisp, drier and clearer atmosphere and their more extreme climate, the Eastern Highlands exhibit quite different features. Surrounded by plains which stretch in from all parts up to the centre, in large straths and glens, they are carved into gigantic rough blocks. Their vegetation is essentially one of heather and dry grass moors on the slopes, with extensive peat caps on the plateaux and terraces under 2500 feet, and alpine deserts on the broad higher summits. Here indeed are found ideal conditions for Scots pine and larch in the

sub-alpine zone, and for mixed oak forests up to 900 feet. After the wholesale disforestation, heather and peat soon got the better of the intended pastures, and ever since ling-burning has extended their power and limits. The eastern section provides far more extensive and better grounds for cultivation in the valleys than the West Highlands. The population is more dense. Villages and even towns are more numerous and important, and also wealthier.

However well-defined and characterised these two sections of the Highlands may be, any attempt at a hard-and-fast line between them would prove futile. From north to south, the border zone is first pushed to the west by the extensive plains of Caithness and Sutherland. It almost touches the west coast near Loch Broom. Thence it winds round the main body of the Westerness hills down to Glen Garry. Shifting then eastwards, it leaves on its right the Roy and Spean hills as well as the Ben Alder *massif*, turns south again and skirts the western extremities of Lochs Rannoch, Tay, and Earn, round Ben Voirlich and the Loch Lomond hills, than which we shall not at present proceed any further.

A closer analysis will reveal, within the two sections hitherto outlined, a number of districts which are defined, in addition to their climate, by local features of soil and relief as bearing on the vegetation. Of these a brief sketch may be given here.

First, in the North-West Highlands may be distinguished a *Lewisian district*, which, besides a geologically well-defined coast-belt, should include the larger portion of the Outer Hebrides. Bestrewn with abrupt and barren rocky knobs, towered above by the weird and solitary torridonian cones, sparkled over with innumerable rock tarns, this is in a way the most picturesque district of Scotland. Its low altitude deprives it of the maximum of atmospheric condensations, while the violence of its west winds adds to the dryness of the rocks. The cut-up nature of the ground precludes alike cultivation, pastures and forests. The vegetation is consequently made of a mosaic of plots of heather and grass, occasional clumps of birch, peaty ditches, and bare crags. The population is of necessity reduced to a minimum.

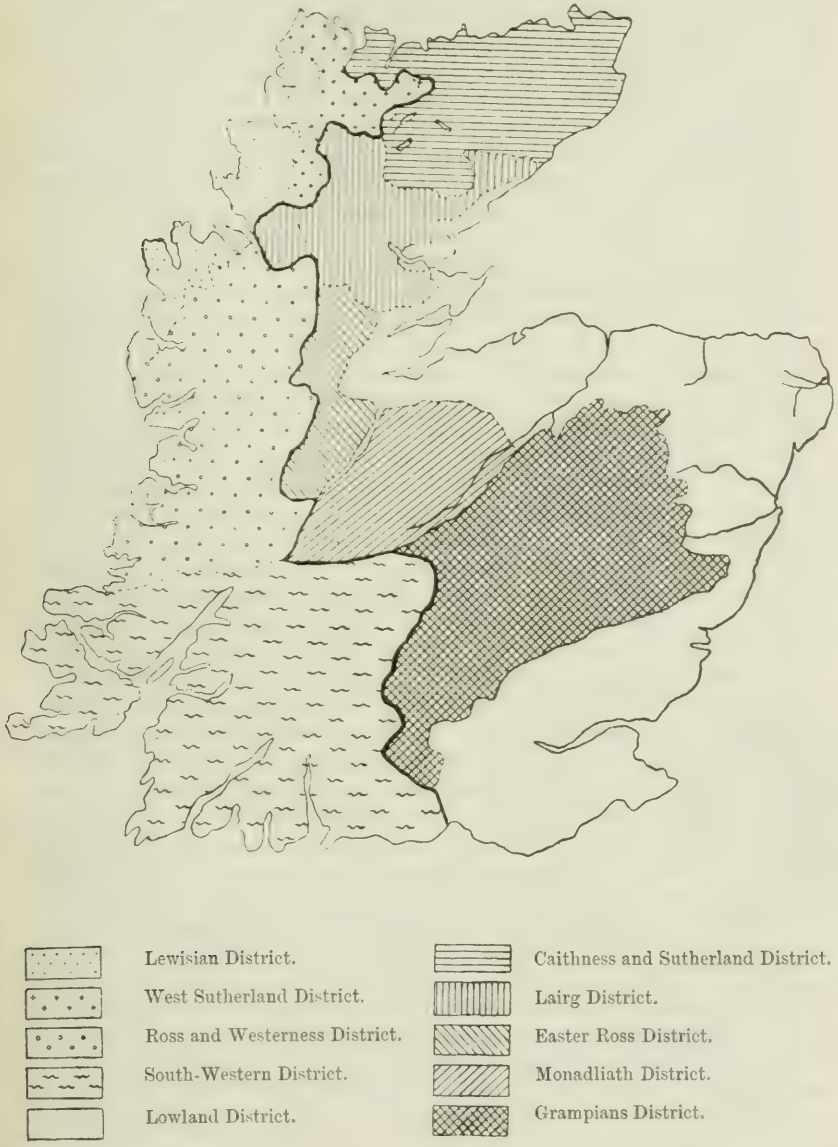
East of this area, a jagged rim of loosely connected, very steep, and much-denuded mountains and short ridges forms a *West Sutherland district* running SSW. to Ben More Assynt. Although the rainfall is higher on these slopes, the strength of the north and west gales would probably prevent the existence of forests. The entirely bare, rocky summit cap descends very low. The landscape is one of fairly good pastures, mostly given over to deer, while peat has taken possession of the low ground. There is hardly any human agglomeration.

South of Loch Broom occurs a monotonous series of parallel narrow and close ridges running in an average east-west direction and entirely carved out of the metamorphic Moine schists. This is the *Ross and Westerness district*.

Blowing mostly from the south-westerly quarters, winds do not show here the same strength as further north, while the rainfall becomes decidedly more abundant, exceeding 80 inches. Tree vegetation,

already flourishing in the sheltered parts of Loch Broom, is here quite

PHYTOGEOGRAPHICAL DISTRICTS OF THE NORTH OF SCOTLAND.



possible. Indeed, there is no doubt that oak forests once prospered well up the hills. In the sub-alpine zone, as may be seen from what

now remains, pine stands once covered all the powerfully drained, drier situations, alternating with pastures and protecting them. Birch was largely mixed with them and formed an upper tree belt. Later on, the grassy swards left to themselves were unable to struggle against denudation, and allowed the soil to be washed away. On the bare mountain sides, regeneration by the less exacting birch is rapidly going on, while the Scots pine has planted itself in a few of the large vacant spaces of the lower zone, where it mostly turns mossy and damp. This district is now practically all under deer forest. Its population is, in consequence, very scanty. Many of its pastures were once in a flourishing condition and afforded good ground for the development of rural industries. Bracken, sweet-gale bogs, and damp grass moors occupy the lower ground.

The *South-Western district* is still rainier and milder, also richer and more varied in its contour, geology, and vegetation. A feature of it is the development of extensive peat moors on the plateaux of Lorne and in the Rannoch area. As a whole, pasture grounds prove of a higher quality than heretofore. But again the splendid forests of which there is record have vanished. A rather surprising display of oak woods goes to indicate the arboricultural potentialities of the district.

In the eastern section we similarly distinguish five well-defined units. The *Caithness and Sutherland district*, undulating, swept by the north gales and consequently dry, offers but dreary moors on boulder clay. Peat vegetation plays here an overwhelming part, only interrupted here and there by heathery braes and mounds. A large tract of the more favoured eastern half has been reclaimed by agriculture. No doubt a careful and persevering protective forestry would be able to restore this unit to its original climatic and soil conditions.

The lower heights which cover most of the Dornoch Firth basin, extend almost to Loch Broom and constitute a geographical unit which we may call the *Lairg district*. In respect of a break in the western mountains' screen and of a higher average altitude, these hills enjoy a stronger rainfall than the northern plain, while they are sheltered from the cold and dry blasts. But the very gentle and rather monotonous profiles assumed by the soft rocks are, as a whole, covered by rough to marshy pastures and damp moors passing, eastwards, gradually into drier grassy and heathery moors. Some valleys are fairly well wooded; beyond question we are here within the limits of profitable timber growth up to nearly 1700 feet, and the qualities both of climate and soil point to economic potentialities of which, at present, no advantage is taken. A somewhat similar, though much poorer and treeless district, is formed by the dreary plateau of the *Monadliath*, at an average altitude of 1500 to 2000 feet, occupied by alternating damp moors, peat bogs and heaths.

The district of the *Grampians* is typical of the conditions of the eastern section as above outlined.

Finally, of the tract of hills situated between the Caledonian Canal and the western section, and truly intermediate in character between west and east, we may make another unit, called the *Easter Ross*

district. Alike by the scenery and the climate it is perhaps the pleasantest to live in. It contains very interesting vestiges of the original forests, while its plantations are extensive and flourishing.

Within the limits of the above units, we may notice further subdivisions, a number of which, possessed of a character and scenery capable of geographical definition, were already recognised by Celtic tradition. Although unable to pursue that line of research, we have often been struck by the impression that such names as Cowal, Argyle, Lorne, Benderloch, or again Morven, Ardgour, Ardnamurchan, Moidart, etc., represent truly geographical units, the study and definition of which would prove very fruitful and interesting.

The above phytogeographical division of the country is of necessity expressed in, indeed based on, the nature and distribution of the plant-associations, as may be seen from the map. To enter into the botanical study of these would be out of place in these pages. A fair though necessarily partial idea of many of them may be gained from former papers on this subject published in this *Magazine*.

Regarding the general distribution of the main associations, it may be useful to call attention to the following features :—

1. The upper forest limit is determined entirely by the wind. It is higher in the east than in the west, at the eastern than at the western exposure, in the south than in the north. Fairly constant at an altitude of from 1800 to 1900 feet in the middle Highlands, it rapidly goes down to from 1400 to 1500 feet on the scattered and exposed mountains of Sutherland, eventually reaching a much lower level on the western slopes of the extreme north-west, which increases in width from south to north and from east to west. It is followed upwards by a pseudo-alpine belt of a few hundred feet in height. Whether this zone could not be partially reclaimed in course of time by modern scientific forestry is yet an open question.

2. A greater abundance and extension of hygrophytic and mesophytic associations characterises the west as *versus* the east, the lower as against the upper zones, the southern as against the northern latitudes. A particular application of this may be found in the distribution of the Scots pine. For, whatever may be ascribed to the instrumentality of man in the present state of depletion of the west, it can hardly be denied that this xerophytic association is here restricted by reason of the climate to the rather overdrained areas. The same observation obtains for the still more xerophytic heather associations, which practically find a western limit to their area of climatic extension in the line of 60 inches of mean annual rainfall. A corresponding eastern or dryness limit was found by P. Graebner for Germany in the isohyet of 25 inches.

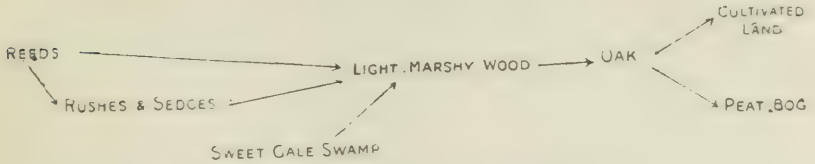
3. The large development of peat moors in the east, which apparently contradicts the above, is simply due to edaphic circumstances of drainage.

We have insisted upon the point that associations should be considered as in process of transformation, however slow, and struggling with and superseding each other. In fact, every geographical unit of environment spontaneously tends to be the seat of a maximum of

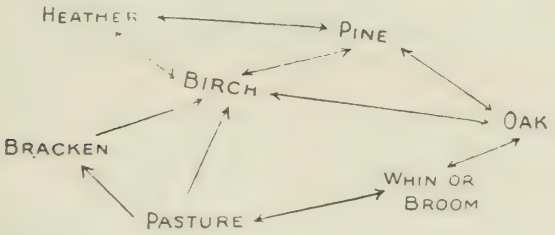
organised and fairly constant symphytic metabolism which may be called its natural *avocation* or *potential*. This potential, not always at first apparent from the present physical conditions, may be raised or lowered by external interference, not to speak of the automatic actions and reactions of synecological dynamics. For instance, the diversion of the course of a river or some drainage operation may transform a light, swampy, alluvial wood into an oak forest. Conversely, bad management of a pine forest may result in a more or less permanent deterioration of the soil and the substitution of heather or other waste moors for pine. Every association thus comes to be regarded as a stage of a possible process of upward evolution or downward devolution. It will be readily seen that, especially in a country like ours, so profoundly modified by man, a map, *i.e.* a purely statistical presentment of a cross section through all these upward or downward processes, gives at best but a very inadequate expression of the potentials of the habitats mapped down. Truly such a map has a great value because the successions of associations in the same habitat are limited. But, short of a series of maps at proper intervals of time, the most instructive and withal the most consistent graphic presentment would be a map of the potentials of the different habitats as shown in the past or in the present. This method is based on a triple assumption: (*a*) that enough time has elapsed since the opening of the present climatic era for the vegetation to show its potential in every situation; (*b*) that thoroughly appropriate species have been available; (*c*) that it is possible, by proper methods, to correctly reconstruct the past avocation of every habitat, and to ascertain whether the alterations have been spontaneous or artificial, are temporary or permanent. While we recognise that the task of reconstructing, often rendered very difficult and beset with uncertainties, is still within the limits of practical application, the point, whether appropriate species have been always available for the attainment of the highest potential, is open to doubt in certain cases. We may well question, for instance, whether, by reason of too early a separation of Scotland from Scandinavia, the sub-alpine zone of the Western Highlands has had the advantage of ecologically quite suitable forest trees and associates, like the Norway spruce; or again, whether there was not room in the Lowlands for the beech and associates whose migration from the south may have been stopped by natural barriers. These points, however, important though they may be in practical forestry, will not, in any way, affect the general value of a map of the natural primitive or potential vegetation.

Short of the latter, it becomes desirable to supplement the statistical registration of the present associations by a few diagrams of successions or evolutive series. In the following, which include the main transformations, the point of the arrow indicates the sense of the change. A double-pointed arrow means a reversible process.

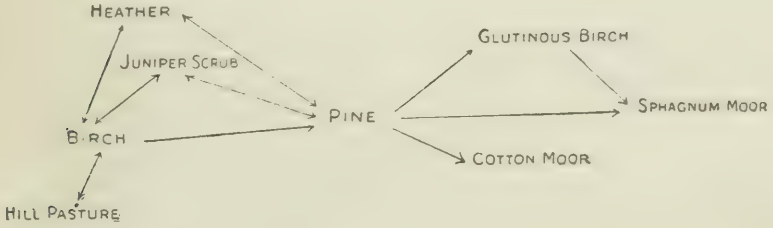
1. *Lowland Oak Woods* (W. G. Smith) *or Carse Oak Woods in moist situations.*



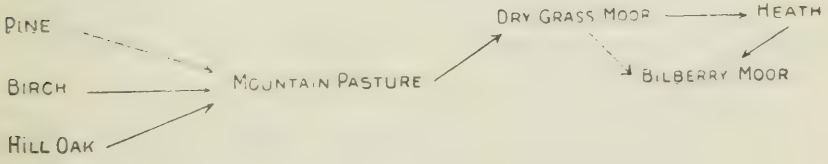
2. *Upland Oak Wood* (W. G. Smith) *or Hill Oak Woods.*



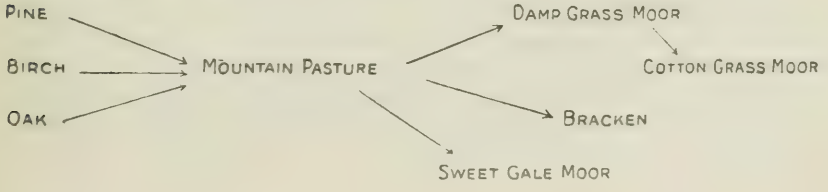
3. *On subalpine slopes.*



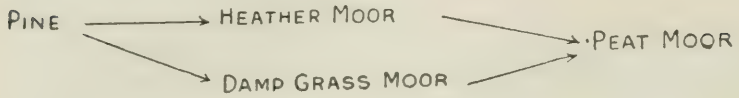
4. *Or again on well-drained slopes.*



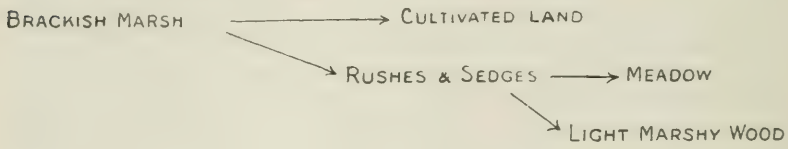
5. *On very gentle, badly-drained slopes.*



6. *On terraces or lower summits.*



7. *In estuarine tracts.*



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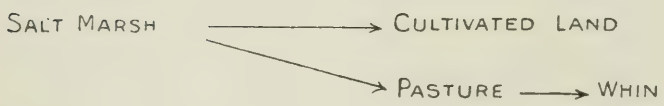

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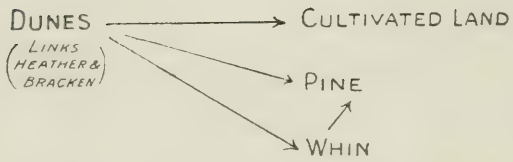

These few diagrams, into which further investigation will introduce more order and details, may suffice, in the meantime, to show the possibilities and interest of this line of research.

The cartographic problem consisted in choosing, among associations of unequal order, equivalent biological units adapted to the scale of the map, and adequately showing the large aspects of the scenery and the main facts of the distribution.

The working scales in this country are the following:—

1 : 10,560, contour 50 ft. 1 : 63,360, „ 100 ft.	Official Ordnance Survey.
1 : 126,720, contour 250 ft. 1 : 633,600 „ 500 ft.	Bartholomew's Reduced Ordnance Survey.

The amount of phytogeographical details a map can stand is strictly controlled by the scale and the contour. As soon as the relations of the topography to the vegetation cease to be clearly seen, *e.g.* on account of the vertical distance of the contour lines, it becomes necessary to take a larger scale. It is obvious that from a synecological survey standpoint, this must vary with the average relief of the country under consideration.

These principles applied to Scotland, and experience gained in the field, lead the writer to the following conclusions :—(*a*) The mapping of detailed formations as shown in R. and W. G. Smith's, requires a minimum scale of 1 : 50,000, with contour lines at every 20 metres. (*b*) More synthetic mapping as here shown requires a minimum scale of 1 : 100,000, with contour lines at every 50 metres. (*c*) The mapping of the lower geographical units, say of sub-districts as above suggested, may be done at a scale of 1 : 500,000, with 150 metres of vertical contour range.

With a view to approaching these desiderata, the scale of 2 in. to mile or 1 : 126,720 was chosen for this map. It has been here reduced, however, for purposes of publication.

The associations registered here are composed of a number of smaller units, grouped by reason of habitual juxtaposition, interchange, and succession.

Dunes,	Links.
	Heather moors.
	Bracken.
Oak and deciduous woods,	Oak.
	Beech.
	Deciduous.
	Light marshy-alluvial woods.
Coniferous woods,	Pine.
	Larch.
	Mixed.
Birch,	*B. verrucosa.*
	B. glutinosa.
Mountain heather moors,	Ling proper.
	Heather.
	Juniper scrub.
Dry grassy moors and patchwork of heath and grass plots (Lewisian).	
Mountain pastures,	Hill pastures.
	Bracken.
	Alpine pastures.
Damp grassy moors	of the Lowlands.
	of the Highlands.
	Myrica moors.
Peat moors,	Sphagnum or Lowland moors.
	Cotton grass or Highland.
Alpine moors,	Bilberry moors.
Summit moors.	
Cultivated land.	

Associations of which the area was too small have been of necessity left out.

THE HISTORY OF THE SCOTTISH PEAT MOSSES AND THEIR RELATION TO THE GLACIAL PERIOD.

By Francis J. Lewis, F.L.S.

(With Diagram and Illustrations.)

The present distribution of peat deposits in the British Isles shows a general tendency to follow the maximum rainfall, the deposits being comparatively scanty on the eastern side of England and Scotland, and increasing in area and thickness as the western coasts are approached ; the greater development occurring in the Hebrides, the western part of the Scottish mainland, and the West of Ireland. In the hill districts they reach their greatest development upon smooth flat-topped hills like the Pennine Chain in England, the elevated plateaux of the Grampian Mountains, and in elevated districts surrounded by mountains, such as the Moor of Rannoch in the West of Scotland. Yet if the peat in such districts is examined, it is found that there are traces everywhere

showing that the present conditions are not sufficiently moist to favour peat growth, for the hilltop, hillside, and upland valley peat, almost without exception, is in a state of rapid denudation, being traversed by channels and furrows often 12 or 15 feet in depth. From large areas, indeed, it has been entirely removed, the edges of the denuded peat forming dark crumbling banks which are being constantly washed away by every heavy rainfall. If the sides of these gullies are examined, the stems and roots of large trees are often seen exposed as the bank is gradually cut back by the stream at its base. Where the peat is deep and the stream has cut its way down to the underlying soil, it becomes evident that the tree-roots and stems are arranged in a definite layer. Sometimes one, more frequently two, and occasionally three such forest layers can be recognised, separated by thick beds of peat, quite free from any traces of trees. These forest-remains are frequently present in the peat in districts where no trees will grow at the present day; to take but two instances, forest-remains are abundant in the peat of the now almost treeless Outer Hebrides, and on the summits of the Grampians at more than 3000 feet above sea-level. The great thickness of many of our peat deposits (sometimes reaching 30 to 50 feet), the known slow rate of growth of peat, and the frequent presence of two forest zones, is evidence that the conditions have changed considerably since the mosses began to form, and a closer examination has shown that large areas of peat in Britain date back to the later phases of the Glacial Period.

On the Continent much work has been done in Norway, Sweden, Denmark, Germany, and Switzerland, upon the history of the peat-bogs, and evidence has been obtained that the lower layers of the peat in certain positions contain the remains of an Arctic vegetation. Owing to the advantages of a continental climate, the plant-remains in the peat of these countries are frequently very well preserved, and the successive floras have been worked out in detail by Gunnar Andersson, Nathorst, Axel Blytt, Steenstrup, Schröter, to name only a few Continental workers in this subject.

The following paper gives a general account of an investigation in which the writer has been engaged, on the peat deposits in the Scottish Southern Uplands, the detailed account of which was published last year.[1]

The peat in the Southern Uplands may conveniently be divided into three types, according to the position in which it occurs :—

(*a*) Peat on the 25-feet raised beach.

(*b*) Lowland peat lying at 100 to 300 feet.

(*c*) Upland valley and hilltop peat lying at 900 to 2000 feet.

Several representative mosses belonging to each of these types were examined as follows :—

25-*feet raised beach.* Priestside Flow near Annan.
Moss of Cree near Newton-Stewart.

Lowland mosses between Newton Stewart and Glenluce.

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[1] "The Plant Remains in the Scottish Peat Mosses." *Trans. Royal Soc. Edinburgh*, vol. XLI. pt. iii. No. 28.

Upland valley and hilltop peat. At 900 to 1000 feet between the Merrick Hills and Kells Range. At 1200 to 2000 feet in Tweedsmuir. At 1800 to 2000 feet on the Moorfoot Hills.

In describing the plant strata contained in these mosses it will be more convenient to take the oldest mosses lying in the upland valleys first, and describe the newer peat on the 25-feet raised beaches later.

From their position in regard to the glacial drifts and moraines, all the mosses so far examined appear to be of later date than the fourth

Fig. 1.—Moraines belonging to the fourth Glacial stage; Winterhope, Tweedsmuir, Selkirkshire. Height 1400 ft.

glacial epoch which, at its maximum, overwhelmed the Southern Upland valleys and adjacent districts with considerable glaciers which, coalescing, often formed district ice-sheets. The moraines belonging to this period are strewn broadcast over the upland valleys of Galloway and Tweedsmuir. In Galloway the valley between the Merrick Hills and Kells Range appears to have been the chief centre of ice dispersal at this period. This valley is about ten miles in length and two to three miles broad, and is bounded on the west by a long range of granitic hills, with an average altitude of over 2000 feet, reaching in the Merrick 2700 feet. On the east side of the valley the ground again rises abruptly to about 2500 feet. Moraines and perched blocks, the former in a very perfect

state of preservation, are numerous, and many of the small lateral valleys are almost blocked by small moraines. Glaciated rocks are frequent, and the striæ all point in directions such as would be caused by local glaciation, when the direction of the ice-flow was entirely determined by the existing contour of the district. The peat occurs round and upon these moraines, and is clearly of younger age than the period during which the glacial deposits were brought down.

In Tweedsmuir much the same phenomena can be recognised. The district between Moffat and Selkirk, in the neighbourhood of the high ground culminating in White Coombe, was selected for investigation. All the valleys in this district bear traces of glaciation, small valley moraines are again numerous, and the peat, as in the Merrick-Kells district, lies amongst and upon the moraines.

As the severe conditions obtaining during this cold period passed away, a gradual immigration of the vegetation took place, but no peat appears to have been formed until the climate had so far ameliorated as to permit the growth of *Betula alba*, L.[1] The first vegetation met with at the base of the peat, both in the Merrick and Tweedsmuir district, consists of a solid layer of the remains of this tree mixed with such plants as *Calluna vulgaris*, L., and *Salix repens*, L. It is hardly probable that these forms represent the primitive vegetation which tenanted the ground; as the glaciers and local ice-sheets gradually retreated, one would have expected that Arctic plants should have been the first to occupy the recently-glaciated ground, later—as the climate became warmer—to be replaced by such forms as *Betula alba*, L., and *Calluna vulgaris*, L. The preservation of the primitive Arctic vegetation would, however, entirely depend upon local and climatic conditions being favourable for its preservation in the form of a thin layer of peat. Many of the sections in the Merrick district showed a thin layer of peat, in which no identifiable plant-remains could be distinguished, occurring under the *Betula alba*, L., and it may be that this layer represents the primitive vegetation of the district. After the birch forest had flourished for a considerable period it passed away, and the peat immediately above is formed entirely from the remains of Sphagnum, indicating a considerable increase in precipitation. That this was not merely a local change caused by alteration of drainage is shown by its persistence over a large tract of country, not only in the Merrick district, but also about sixty miles distant in Tweedsmuir, both at the bottom of valleys, upon steep hillsides, and on flat hilltops. These Sphagnum beds then represent a change from birch-forest conditions to wet moorland. As successive layers of the peat are examined the Sphagnum gradually gives place to *Eriophorum vaginatum*, L., with traces of Scirpus. So far, the succession of vegetation agrees exactly both in the Merrick mosses and in Tweedsmuir. After some six to eight inches of Eriophorum peat had been deposited, a decided change in conditions took place. In the Merrick peat the Eriophorum becomes replaced by a dense layer of the stems of *Empetrum nigrum*, L., *Salix herbacea*, L., and

[1] The nomenclature of Hooker's *Student's British Flora* is followed throughout.

S. reticulata, L.; in the Tweedsmuir peat the Eriophorum merges above into peat formed from *Empetrum nigrum*, L., and *Loiseleuria procumbens*, Desv. Now, *Salix herbacea*, L., *Salix reticulata*, L., and *Loiseleuria procumbens*, Desv., are typical Arctic plants, and their presence at a certain level throughout the peat in Galloway and Tweedsmuir points unmistakably to a decided decrease in temperature—to a time, in fact, when the valleys in the South of Scotland had a climate at least as rigorous as that at

FIG. 2.—Arctic plant bed and *Pinus sylvestris* zone (Upper Forest), Merrick-Kells mosses, Ayrshire. The Arctic plant bed can be seen projecting as a ledge from the bank of peat just above the stream.

present obtaining on the summits of the highest Scottish mountains. If these conditions then obtained over the low ground in the south, it can scarcely be doubted that local glaciers would exist amongst the high ground in the North and West Highlands. In fact, we should have a repetition of events which occurred during the preceding glacial period: only now, instead of large valley glaciers in the Southern Uplands and ice-sheets in the Highlands, we should have cold conditions in the Southern Uplands (represented by the Arctic plants intercalated in the peat) and valley glaciers and local ice-sheets in the Highlands. From the geological evidence Professor Geikie puts the snow level in the Southern Uplands at this time at about 2400 to 2500 feet—just sufficient to give a permanent snow-cap to Merrick.

The gradual dying away of this cold period and the incoming of a forest vegetation is faithfully reproduced in the peat. The Empetrum, Arctic willows, and creeping azalea, give place above to beds of Eriophorum, succeeded by Sphagnum, both in the Merrick and in the Tweedsmuir peat. Later, the wet moorland conditions represented by this moss yield to pine forest in the Merrick valleys and *Betula alba* in Tweedsmuir. This upper forest zone has been traced in many districts, both in the south of Scotland and in the Highlands. In most districts *Pinus Sylvestris* was the dominant tree, particularly in the Highlands. Amongst other districts the upper pine zone has been noticed by the author in parts of Caithness, Sutherland, Easter and Wester Ross, over many of the watersheds in Inverness-shire, and on the Moor of Rannoch. In Tweedsmuir and in other parts of the Southern Uplands the ground at this time was covered with birch. Calluna occurs in considerable quantity both amongst the pine and birch.

This forest period at length came to an end and was succeeded by wet conditions, as the peat immediately above the forest zone is formed from Scirpus, Sphagnum, and Eriophorum.

Geological evidence is not wanting that at about this time there was again a recurrence of cold conditions, though much less marked than the previous one. This evidence consists in the appearance of numerous small moraines at about 3500 feet in corries on many of the Highland mountains. There is, however, no evidence of this later change to cold conditions in the Southern Upland peat, and indeed its occurrence has not so far been found to have influenced the contemporary vegetation in the Highlands. The peat which lies in corries at about 3000 to 4000 feet has yet to be examined, and it is possible that Arctic plants representing the dying away of this latest phase of the glacial period may be found in such positions. From the evidence collected so far from the peat mosses, it would seem that this period was not characterised by great cold over the northern part of Scotland, and it is suggested that a comparatively slight fall in temperature with increased precipitation, coupled with more cloudy summers, would suffice to produce glaciers in many of the smaller and more shaded corries at the present time. In connection with this, attention might be directed to the corrie of Allt-a-Mhuilinn on the north-east of Ben Nevis. In *Symons's Meteorological Magazine* for March 1905 a description is given by the Rev. R. P. Dansey of the snow-beds lying in this corrie. Here the snow-beds never melt, and a few inches below the surface ice is encountered, and this mass of snow and ice—estimated to be considerably over 50 feet in depth—is slowly moving downwards. If, then, present conditions will produce such a semi-glacier, together with extensive snow-beds in the Cairngorms, it may well be questioned whether we require a great decrease in temperature to produce small corrie glaciers in some of the Highland districts.

As the corrie glaciers were succeeded by more temperate conditions, elevation took place, and the 25-feet beach became raised, and the history of the peat in this position begins.

The first vegetation met with at the base of the raised beach peat

consists of *Corylus Avellana*, L., *Betula alba*, L., and *Alnus glutinosa*, Gærtn., which later give place to a great growth of Phragmites on some of the beaches, and mosses such as Hypnum and Polytrichum on others. Whilst this vegetation flourished on the raised beaches, the interior and higher-lying parts of the country remained covered with the Scirpus-, Sphagnum-, Calluna-, Eriophorum-association which occurs above the upper pine and birch zone. On the raised beaches the Phragmites and moss vegetation gradually passed away and were succeeded by a type of vegetation essentially similar to that found inland. There is no sign of any change in conditions later than this, as above the pine zone in the inland districts, and the Phragmites zone on the raised beaches, the peat is wholly formed from plants indicating wet moorland conditions. As the upper layers of peat are reached within a foot or so of the surface, the remains of the present vegetation begin to make their appearance. It may be remarked here that the vegetation at present covering the peat areas is nearly always of a drier type than that found at slightly greater depths in the peat, and this fact is not without its bearing upon the present denuded state of the mosses. The peat deposits in Galloway and Tweedsmuir thus give the general facies of the flora since the passing away of the valley glaciers of the Southern Uplands; the subsequent recurrence of cold conditions (resulting in glaciation of the Highlands, and tundra conditions in the south) being indicated by the Arctic plants lying between the lower and upper forest. It is frequently the case that drifted pine stools of large size are found imbedded at the base of the 25-feet beach peat. These drifted pine roots have been noticed in great numbers at the base of the Moss of Cree, and in many places they lie imbedded in the mud of the raised beach. It is extremely probable that these trees belong to the pine zone of the inland districts. The submergence to the extent of 25 feet was a cold period during which forest clearance went on to a great extent over the Southern Uplands, and these trees were drifted down and became imbedded in the mud of the gradually emerging beach.

A brief comparison may be made between the mosses described in the Southern Uplands and those examined during 1905 in the Highland districts. The Highland mosses began their history at a stage later than the peat examined in the Southern Uplands. In the north none of the beds below the Arctic plant zone of the Southern Uplands are present, as the recurrence of cold conditions represented by the Arctic bed in the south produced glaciation in the north, thus sweeping away all peat beds representing the preceding interglacial period during which the lower forest beds of the Southern Uplands were formed.

As the valley glaciers and local ice-sheets in the Highlands began to pass away, a tundra-like vegetation spread over the ground, represented at the base of the peat in Caithness-shire, Easter Ross, and Inverness-shire, by thick beds formed of *Salix Arbuscula*, L., *Potentilla Comarum*, Nestl., *Betula nana*, L., and *Empetrum nigrum*, L. The general character of this bed is not unlike that occurring above the basal birch in the Merrick-Kells mosses. Seeing this, and also that the strata

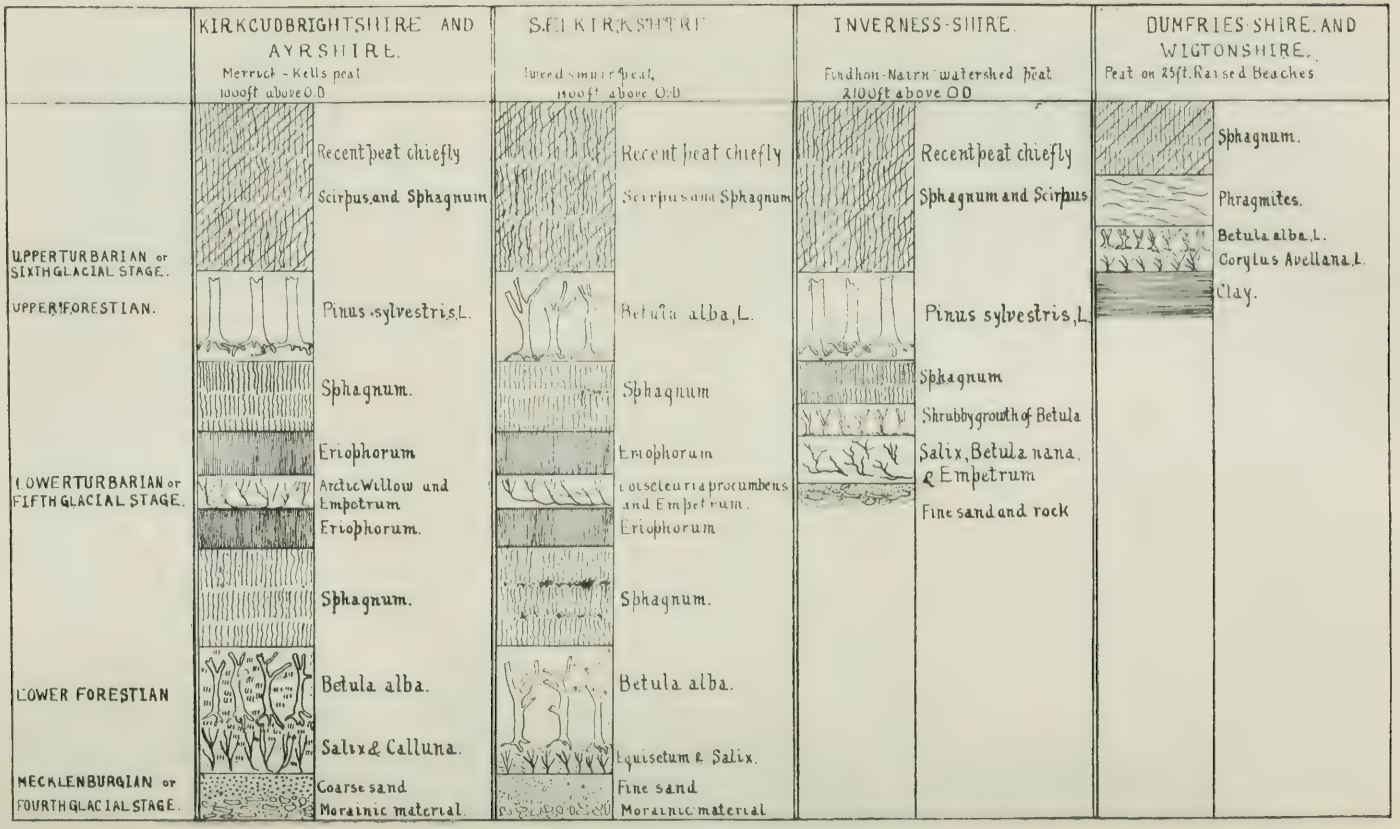


Diagram illustrating the Succession of Plant Remains.

above are, both in the south and in the Highlands, the same in sequence, we can scarcely doubt that they are contemporaneous, the Arctic bed in the south representing the whole valley-glacier episode, whilst the tundra-like vegetation preserved at the base of the northern peat represents the passing away of the same period. Later than this the climate appears to have become more genial; this is indicated by a widespread growth of shrubby *Betula alba*, well developed on some of the watersheds in Inverness-shire. In many places this *Betula alba* layer is mixed with and overlaid by Sphagnum beds, which above give place to a zone of pine forest. As the beds between the basal tundra vegetation and the pine layer agree in general characters with those found, for instance, in the Merrick-Kells mosses, this pine zone of the Highlands is presumably contemporaneous with that of the Southern Uplands. It will be noticed, however, that Eriophorum and then Sphagnum overlies the Arctic zone of the Southern Uplands, whilst shrubby *Betula alba* and Sphagnum overlies the corresponding bed in the Highlands. This difference is, perhaps, to be expected, seeing that the Merrick-Kells mosses lie in a trough, and this would favour the uninterrupted growth of Sphagnum, whilst the Highland peat instanced lies on the summit of an elevated watershed and would favour drier conditions; added to which, the Merrick-Kells peat at this stage would be some 5 feet in depth, whilst the Highland peat would only be 2 to 2½ feet deep.

Just before the pine zone is reached the Sphagnum remains begin to contain abundant traces of the stems of Calluna, and this continues in the Scots pine layer. This is supported by what we find at the present day, Calluna being one of the commonest gregarious plants accompanying open pine forests. After a time the pine forest in its turn passed away and was replaced by wet condition moorland plants, which have continued in the several areas down to the present day. It is interesting thus to find a considerable resemblance between the history of the mosses in upland districts in the south and the north. The Highland example just given began its history one interglaciel period later than the Southern Upland peat on account of the later glaciation of the northern districts; after that both have proceeded along parallel lines, a gradual amelioration of conditions is indicated by Sphagnum, *Betula alba*, and Eriophorum beds succeeding the Tundra vegetation, a temperate forest period by the widespread growth of *Pinus sylvestris* of very large size between 2000 to 3000 feet in the Highlands, and then a relapse to wet moorland conditions down to the present day.

It may be pointed out that the successive floras described only indicate the sequence of vegetation over wet peaty areas; were the history of the drier districts preserved in the form of peat it would undoubtedly show much greater variation. It is chiefly owing to the great growth of Sphagnum beds in late glacial and postglacial times that these successive changes have been sealed up and preserved to the present day.

The different strata which have been described show that the rate of growth of the peat has not by any means been uniform since the mosses

began to form. Each forest bed indicates a pause in peat formation. Although in the Southern Uplands the upper forest zone is represented by a single layer of the stools of large Scots pine, it might be that this only represents the last generation of trees that grew at this forest period. The preservation of the trunks and stools would depend upon their being quickly enveloped in Sphagnum; several generations of trees might arise and decay, leaving little trace; the latest generation would,

FIG. 3.—*Pinus sylvestris* zone exposed by denudation at 2200 feet, on Coire Riabhach, Banffshire.

however, be well preserved by the succeeding Sphagnum quickly covering the remains.

It will be seen, then, that at certain recurring periods all the peat mosses were under dry conditions, being covered with forests of Scots pine and Calluna; and the question arises as to the distribution of wet moorland types during such a forest period. They could scarcely have been represented to any great extent in the areas under consideration, if the wettest peat mosses were clothed with pine and Calluna. The general succession of plant strata in the Hebridean peat may supply the answer. In the Hebrides, so far as the evidence at present available goes, the upper forest zone is wanting, and its place is taken by thick

beds of Eriophorum, Scirpus, Sphagnum, Phragmites, and Equisetum. It would seem, then, that the plants typical of wet moorland conditions were forced westward during a dry forest period; the ground they formerly occupied farther east became tenanted with pine and Calluna; and the wet moorland plants were chiefly restricted to those districts, such as the Hebrides and the outlying portions of the western mainland, which must always have had—even during dry continental conditions—a fairly moist insular climate. If that is so, the subsequent immigration of the wet moorland flora at the passing away of the forest period must have come from the west rather than the east, and this would explain several points in the present distribution of moorland vegetation which are at present obscure.

The evidence at present available from the Scottish peat mosses, then, gives strong support to the view brought forward many years ago by Professor Geikie, that the later phases of the glacial epoch were separated by fairly lengthy genial interglacial periods. Certainly, the presence of the intercalated Arctic plants in the Southern Upland peat is only explainable on that view. If the valley moraines so widely distributed over the Southern Upland valleys at about 900 to 1200 feet merely mark the retreat of the last general ice-sheet, and from that time forward there was no recurrence of cold conditions, how is it that the birch forests at the base of the Galloway peat are overlaid by Arctic plant beds? The sequence of:—

1. Birch Forest (lower buried forest),
   1*a*. Wet moorland;
2. Arctic plant beds,
   2*a*. Wet moorland;
3. Pine forest (upper buried forest),
   3*a*. Wet moorland;

is exactly what might have been expected if the glacial sequence was:—

1. Genial interglacial period following the local ice-sheets of the Southern Uplands.

2. Valley glaciers in the Highlands and cold conditions in the south of Scotland.

3. Dry interglacial or forest period gradually passing away until the present conditions came in.

The latest return to cold conditions represented by the corrie glaciers was so slight that it could scarcely, at moderate elevations, have affected the flora to any appreciable extent, either in the south or north, except that it might possibly have produced a more rapid rate of growth in the peat. Although conclusive evidence of this could scarcely be expected from the peat, one or two facts have come to light which suggest that after the passing away of the pine forest or "upper forest zone," the climate became so much moister that peat was enabled to form on hillsides too steep to favour its growth before. This is shown by the fact that—particularly in the Highlands—the peat on some of the steepest hillsides does not contain a forest zone, all the peat being formed from wet condition moorland plants, dating apparently from the time immediately following the upper forest period. This is just the

time when the corrie glaciers would come into existence, and it is this peat which now is in a state of rapid denudation.

The question of the succession of glacial epochs has been referred to in several places in this paper. As this is a point which touches upon the geological, geographical, and botanical aspects of the subject, it has been suggested to me by Professor Geikie that it would be advisable to add a general statement of the succession of events during the later phases of the glacial period. I do this with greater confidence, since Professor Geikie has kindly drawn up the following table:—

SUCCESSION OF THE LATER GLACIAL AND INTERGLACIAL STAGES IN SCOTLAND.

Upper Turbarian or Sixth Glacial Stage.
High-level corrie glaciers, with snowline at 3500 feet; peat overlying Upper Forest; raised beaches at 25 to 30 feet; somewhat cold and wet climate.

Upper Forestian or Fifth Interglacial Stage.
Upper Forest overlying Lower Peat; relatively dry and genial climate; land area somewhat more extensive than now.

Lower Turbarian or Fifth Glacial Stage.
Valley-glaciers, with average snowline at 2400 to 2500 feet; Lower Peat overlying Lower Forest; raised beaches at 45 to 50 feet; cold and wet climate.

Lower Forestian or Fourth Interglacial Stage.
Lower Forest overlying morainic accumulations of Fourth Glacial Stage; genial climate; land area of greater extent than now.

Mecklenburgian or Fourth Glacial Stage.
District ice-sheets and large valley-glaciers of Highlands and Southern Uplands; raised beaches at 100 to 135 feet; Arctic climate, with snowline ranging from 1000 feet in west and northwest to 1500 feet or thereabout in Central Scotland.

SOME METEOROLOGICAL RESULTS OF THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

By R. C. MOSSMAN, F.R.S.E.

(*With Plates.*)

IN previous papers published in the *Scottish Geographical Magazine*,[1] I gave a general summary of the meteorological results of the Scottish National Antarctic Expedition viewed more particularly from a climatological standpoint. Since these were issued, the observations have been discussed in relation to the diurnal variation of the climatic elements, while thermal, baric, and other windroses have been computed for that portion of the *Scotia's* two summer cruises lying south of 60° S. As

[1] Vol. xx. pp. 113-120; vol. xxi. pp. 417-429.

some months will yet elapse before the final report appears, it seems desirable to give the preliminary results of the above discussion, in order that the data may be immediately available for comparison with the results obtained at the South Orkney Station during the year 1904, and with those of other Antarctic expeditions now in course of publication.

It may be recalled that the meteorological and magnetical station at Omond House, Laurie Island, South Orkneys, was taken over by the Argentine Government in February 1904, and that observations have been carried on there since, in connection with the Argentine Meteorological Office. Mr. Walter G. Davis, the able director of this department, has earned the grateful appreciation of all meteorologists by his successful efforts to extend our knowledge of the meteorology of the Antarctic and sub-Antarctic areas lying to the south and west of Cape Horn. Not only are continuous hourly observations now available for the South Orkneys since March 1903, but this year has witnessed the establishment of a new station at South Georgia Island, while the further installation of an observing station on one of the South Sandwich group and at Wandel Island in 65° 04′ S. is contemplated in the immediate future. The practical importance of this great work can hardly be overestimated, more particularly in relation to the maritime community, since it will result in the formulation of a system of rules which will doubtless enable the navigator bound westward round Cape Horn to determine the most favourable course for making this too often tedious and dangerous passage. It has been frequently observed that very good passages are made by standing well to the southward even as far as 61° S.; but until the accumulated data have been discussed and co-ordinated, and the course of cyclonic storms south of 40° carefully studied in relation to the different winds and weather in the immediate vicinity of the Horn, it would be premature to draw up a code of rules adopted to these different conditions. Hence the importance of this new network of stations in enabling a synchronous weather chart to be drawn for a wide area, extending as far as 65° S., between the meridians of 30° and 80° W.

In any discussion dealing with the thermal and other conditions experienced with different winds, it is necessary to have a knowledge of the climatological characteristics of the regions over which the winds blew before reaching the point of observation. The area dealt with in this inquiry being south of 60° S., and between the meridians of 10° and 49° W., refers almost wholly to a sea surface in which a uniform temperature obtained. Table I. shows the mean surface temperature of the sea south of 30° S., and it will be observed that in both cruises the sea temperatures recorded over the area under discussion range from 31·8 to 28·9 F., if we except the single reading of 33·2° recorded in lat. 61° 28′ S. long., 41° 55′ W., during the second cruise. The period covered by the first summer cruise in 1903 extended over the fifty-three days ending with 26th March, while the second embraced the thirty-eight days terminating on 31st March 1904, those periods corresponding to the late summer and early autumn of the southern hemisphere. The surface sea temperatures, as well as those taken at great depths, will be discussed in relation to general hydrography in the report dealing with oceanic circulation, and

TABLE I.—Showing the Surface Sea Temperature of the South Atlantic and Weddell Sea.

Note.—The means are in most cases the average of readings made every four hours.

Date.	Lat. S.	Long. W.	Sea Temp.
1902	° ′	° ′	°
Dec. 27	32 10	47 30	74·8
28	33 50	48 44	72·7
29	35 28	50 34	70·2
30	35 23	49 53	67·9
31	36 39	52 10	69·4
1903			
Jan. 1	39 01	53 40	66·0
2	41 38	54 40	57·9
3	45 29	56 03	55·0
4	47 37	57 25	49·8
5	49 55	59 44	48·1
First Antarctic Cruise.			
27	52 55	55 00	44·4
28	54 35	51 50	42·2
29	56 10	49 20	..
30	56 28	47 52	35·5
31	58 14	45 15	35·5
Feb. 1	59 32	43 10	33·5
2	60 28	43 40	30·4
3	60 23	44 00	30·3
4	60 47	44 00	30·0
5	61 06	43 40	30·3
6	60 10	42 35	31·6
7	60 03	39 44	30·3
8	59 44	36 40	30·7
9	59 42	34 13	29·8
10	60 05	32 10	29·5
11	60 03	32 31	29·7
12	59 49	31 32	29·6
13	59 43	30 44	30·0
14	59 33	27 37	30·2
15	61 37	26 10	30·6
16	62 52	25 00	30·8
17	64 18	23 09	31·5
18	66 05	23 46	30·9
19	68 33	24 31	29·6
20	69 39	22 58	29·0
21	69 46	19 10	29·3
22	70 21	17 00	29·0
23	69 57	16 53	29·0
24	69 52	17 22	29·0
25	69 44	18 02	..
26	69 36	20 20	29·1
27	69 32	24 00	29·0
28	69 22	26 36	29·1
Mar. 1	69 03	28 02	29·0
2	68 40	30 18	28·9
3	68 35	31 56	29·0
4	68 22	32 35	29·2
5	68 11	34 17	29·0
6	67 39	36 10	29·0

Date.	Lat. S.	Long. W.	Sea Temp.
1903	° ′	° ′	°
Mar. 7	67 33	36 35	29·5
8	67 22	37 36	28·9
9	67 10	39 00	29·1
10	66 40	40 35	29·3
11	66 32	42 20	29·0
12	65 29	44 06	28·9
13	64 48	44 26	..
14	64 32	43 45	29·8
15	64 12	42 15	28·9
16	63 51	41 50	..
17	63 08	42 30	29·6
18	62 10	41 20	..
19	61 22	42 05	29·0
20	61 05	43 20	29·4
South Orkneys to Buenos Ayres.			
Nov. 28	59 43	48 10	32·7
29	58 28	51 56	34·2
30	57 10	55 35	33·8
Dec. 1	54 55	57 28	42·0
2	52 11	57 55	44·9
12	44 08	57 30	49·2
13	42 30	59 18	50·0
14	40 32	58 33	54·8
15	38 24	57 42	61·8
16	Off C. Corientes		62 0
18	,,		63·0
19	,,		61·5
20	,,		67·2
Buenos Ayres to Falkland Islands.			
1904			
Jan. 23	36 57	55 45	73·0
24	39 24	55 02	58·2
25	40 59	55 04	61·6
27	43 33	55 07	60·0
28	45 31	55 21	56·1
29	47 47	56 08	54·2
30	50 03	57 58	50·2
Second Antarctic Cruise.			
Feb. 10	53 22	56 05	45·9
11	55 47	54 19	40·8
12	57 47	51 40	36·5
13	59 56	49 30	36·0
23	61 28	41 55	33·2
24	62 49	38 12	31·7
25	64 29	35 29	31·0
26	65 59	33 06	30·5

Date.	Lat. S.	Long. W.	Sea Temp.
1904	° ′	° ′	°
Feb. 27	66 26	31 25	29·8
28	66 21	28 30	29·8
29	68 08	27 10	29·6
Mar. 1	68 43	24 15	30·1
2	71 04	23 10	30·7
3	72 18	17 59	30·7
4	72 22	18 13	30·4
5	72 31	19 00	29·2
6	73 20	21 28	28·9
7	74 01	22 00	28·9
14	73 11	23 53	29·0
15	71 50	23 30	29·2
16	71 28	23 32	29·0
17	71 22	18 15	29·6
18	71 22	16 34	29·9
19	71 32	17 15	29·8
20	71 17	18 50	30·4
21	69 33	15 19	31·0
22	68 32	10 52	31·8
23	68 32	12 49	31·1
26	67 36	12 05	30·9
27	66 57	11 13	30·8
28	65 58	11 24	31·0
29	63 54	10 42	31·2
30	61 05	12 47	31·3
31	60 37	12 16	31·2
April 2	58 40	12 23	33·0
3	56 55	10 00	32·9
8	52 33	9 47	35·0
9	51 07	9 31	35·3
10	49 25	9 21	39·0
11	48 53	9 25	39·4
12	48 00	9 50	40·0
13	48 06	10 05	40·8
14	46 35	10 10	42·9
15	45 54	10 04	44·2
16	45 25	10 19	44·2
17	44 30	9 43	47·8
18	43 21	8 30	52·0
19	42 57	8 13	50·8
20	41 30	9 55	55·0
22	40 20	9 56	55·2
24	39 58	8 26	55·2
25	40 22	5 45	53·0
26	41 15	2 38	51·9
27	40 33	0 07E	51·4
28	40 08	1 50	52·4
29	39 48	2 33	53·8
30	39 27	5 50	55·5
May 1	39 25	10 25	55·5
2	38 06	14 32	64·9
3	35 37	15 03	64·7
4	34 58	17 00E	63·0

they are only referred to here in so far as they have relation to the meteorological characteristics of the winds over the area under consideration. Attention may, however, be drawn to the rapid fall in surface sea temperatures which takes place between 54° 30′ and 58° South latitude, between the meridians of 57° 30′ and 45° West, and between 48° and 52° 30′ S. lat. on the 10th meridian west of Greenwich, which have an intimate bearing on the course of cyclonic storms in those regions and the accompanying strong winds, which attain their greatest strength and persistence from 40° to 60° S., or over that portion of the South Atlantic where the fall in both sea and air temperature proceeds at a rapid rate.

Climatic Features of the Different Winds in the Weddell Sea.

Table II. shows the mean barometric pressure, temperature, etc., experienced in the Weddell Sea with different winds during the two summer and early autumn cruises of the *Scotia* in the years 1903 and 1904. Except for a few days in February 1903, when the track of the *Scotia* was sometimes a little to the north of 60° S., the data refer to a region south of this latitude, between the meridians of 47° and 11° West. The windroses of the different elements are graphically shown in the plate, Figs. 1 to 7, the data being the mean of all the observations. It may be remarked that the columns headed "Mean" in Table II. are not the averages of the values given in the columns for 1903 and 1904, but are the arithmetic means obtained by dividing the sums of the values for both periods by the total number of wind observations. The necessity of this is so obvious that further explanation is unnecessary. Table III. shows the departure from the general mean of the values obtained with different winds during each of the cruises, as well as for the whole period. In comparing the windroses of 1903 with those of 1904, it is necessary to bear in mind the difference between the extent and distribution of the pack ice in the two seasons. In 1903 the *Scotia* met the pack in 60° 20′ S., long. 43° 50′ W., and, except for a few days when in the neighbourhood of the Antarctic Circle, was in the pack, which probably completely filled the south and west part of the Weddell Sea from Graham's Land to the point of observation. In 1904, on the other hand, an almost open sea prevailed, and no obstacle in the shape of pack was met with until off Coats Land in 72° 18′ S., long. 17° 59′ W. This doubtless had an important bearing on the track taken by depressions in the two seasons, which will be elucidated when the daily synoptic charts in course of preparation by the Deutsche Seewarte and the Meteorological Office are completed.

The following are the more prominent features of the windroses in the two seasons:—

Pressure.—In 1903 pressure was highest with winds from the SSW., secondary maxima being shown with winds from the N., ENE., and NNE.; on the other hand, the lowest mean pressures were with winds from the SSE. to E. In 1904 the maximum values were with S., SSE., and SE. winds, and lowest with ENE. winds.

Temperature in both seasons was, as might be expected, lowest with

TABLE II.—Showing the Mean Barometric Pressure, Temperature, Amount of Cloud, Wind Force, Relative Humidity, and Vapour Pressure experienced with winds from various directions in the Weddell Sea South of 60° S.

Note.—For 1903, the period to which the Observations refer is from February 2 to March 26, and in 1904 from February 23 to March 31.

	Mean Barometric Pressure. At 32° and Sea Level.			Mean Air Temperature.			Mean Amount of Cloud.			Mean Force of the Winds.			Mean Relative Humidity.			Mean Vapour Pressure.			Wind.			Wind. Number of Observations.		
	1903.	1904.	Mean.	1903.	1904.	Mean.	1903.	1904.	Mean.	1903.	1904.	Mean.	1903.	1904.	Mean.	1903.	1904.	Mean.	1903.	1903.	Mean.	1903.	1904.	Total.
	Inches.	Inches.	Inches.	°	°	°	0-10.	0-10.	0-10.	0-12.	0-12.	0-12.	Per cent.	Per cent.	Per cent.	Inch.	Inch.	Inch.	Per cent.	Per cent.	Per cent.			
N.	29·185	28·780	29·014	28·9	28·7	28·9	9·8	9·5	9·7	2·1	2·9	2·5	81·8	90·8	85·6	·132	·146	·138	10·3	10·4	10·3	131	95	226
NNW.	29·050	28·830	28·975	29·4	28·3	29·0	9·7	9·7	9·7	1·9	3·0	2·3	86·6	91·1	88·2	·145	·142	·144	5·7	4·4	5·1	72	40	112
NW.	28·856	28·934	28·898	29·0	26·3	27·5	9·8	9·1	9·4	2·2	2·6	2·4	85·5	86·2	85·9	·138	·124	·131	6·5	11·0	8·4	83	100	183
WNW.	29·054	28·945	28·986	26·8	25·1	25·7	9·2	9·5	9·3	2·3	3·1	2·8	81·0	87·8	84·7	·119	·122	·121	2·2	4·7	3·2	28	43	71
W.	28·975	29·140	29·069	25·4	28·7	27·3	8·4	9·3	8·9	3·5	2·5	3·0	80·0	86·0	83·5	·111	·136	·126	5·6	10·9	7·8	71	99	170
WSW.	28·981	29·276	29·098	26·6	24·3	25·7	8·7	7·6	8·3	2·2	2·4	2·3	79·8	59·0	71·7	·139	·085	·118	3·8	3·4	3·6	48	31	79
SW.	29·048	28·779	28·911	27·0	26·1	26·5	8·9	8·0	8·5	1·8	2·4	2·1	79·3	69·2	74·3	·119	·106	·113	7·9	10·7	9·1	100	98	198
SSW.	29·249	28·935	29·100	22·6	22·0	22·3	9·3	8·0	8·7	1·9	2·5	2·2	85·9	63·2	75·5	·107	·083	·096	3·1	3·9	3·5	40	36	76
S.	29·130	29·307	29·184	22·6	20·6	22·0	8·7	6·4	8·0	2·2	0·6	1·7	81·1	77·0	79·5	·101	·089	·097	6·8	4·2	5·7	87	38	125
SSE.	28·914	29·203	29·012	23·7	25·8	24·4	9·4	6·7	8·5	2·8	1·2	2·2	84·7	78·6	82·6	·109	·112	·110	3·0	2·2	2·7	39	20	59
SE.	28·799	29·116	28·903	24·8	27·4	25·6	9·4	8·4	9·0	2·4	1·3	2·1	83·7	80·7	82·7	·112	·120	·115	5·5	3·7	4·8	70	34	104
ESE.	28·789	28·910	28·817	27·2	25·0	26·7	9·5	8·9	9·3	2·7	2·8	2·7	82·6	81·0	82·3	·124	·108	·120	4·2	1·8	3·2	54	16	70
E.	28·853	28·877	28·865	27·9	23·3	25·7	10·0	8·7	9·4	3·6	3·3	3·5	81·5	87·5	84·4	·126	·111	·119	5·1	6·8	5·8	65	62	127
ENE.	29·189	28·762	28·966	28·3	23·1	25·6	9·6	9·6	9·6	2·3	3·9	3·2	78·5	91·9	85·5	·123	·105	·113	4·2	6·5	5·2	54	59	113
NE.	29·110	28·957	29·070	27·3	25·9	26·9	9·7	8·3	9·4	2·6	1·9	2·4	83·8	86·9	84·7	·121	·136	·128	13·4	6·7	10·6	170	61	231
NNE.	29·185	28·787	29·099	28·0	27·9	28·0	9·8	9·5	9·7	2·0	2·9	2·3	85·0	92·5	86·6	·132	·142	·135	7·1	2·7	5·3	90	25	115
Calm	29·123	29·259	29·181	24·9	21·7	23·5	8·1	6·9	9·5	..	..	..	79·3	78·8	79·1	·109	·083	·098	5·6	6·0	5·7	70	55	125
Mean	29·044	28·960	29·009	26·8	25·7	26·4	9·4	8·7	9·1	2·4	2·6	2·5	82·9	82·7	82·8	·123	·118	·121	100·0	100·0	100·0	1272	912	2184

southerly and highest with northerly winds, there being, however, in 1904 a very pronounced secondary minimum with easterly winds, due to the prevalence of these winds when in the far south off Coats Land.

Humidity.—In 1903 the values of relative humidity for different winds are somewhat irregular, the dampest being NNW., which, blowing from relatively warm regions, bring masses of water vapour to be chilled and condensed in the higher latitudes. The driest winds, on the other hand, were from the ENE., but winds from WNW. to S. were also characterised by low relative humidities, which is easily explained by the circumstance that there were no expanses of open water in these directions, the whole area being filled with pack ice. In the 1904 cruise winds from WSW. to SSW. were very dry, while those from E. round by N. to W. were damp, the excessive dryness of the former being due to the circumstance that they blew off the extensive land surfaces to the south-west indicated by the discovery of Coats Land, while in other directions there was open sea. The values for *vapour pressure* are much the same for both seasons, the greatest being with northerly and the least with southerly winds, while the amount of *cloud* shows substantially the same distribution. With regard to the strength of the *wind*, the observations indicate that the lightest winds are from the south and the strongest from the east. Now in the southern hemisphere the wind circulation in cyclonic systems is against the sun, so that north of the centre the winds are westerly, while south of the centre they are easterly. It is therefore evident that the steepest barometric gradients were associated with the passage of depressions whose centres were to the northward of the *Scotia's* track. It is interesting to note that practically all the east winds recorded during the two cruises of the *Scotia* were experienced to the south of the Antarctic Circle, so that the normal track of depressions in the Weddell Sea in summer was to the north of this latitude. The observations thus point to the presence of a high-pressure area over the Antarctic Continent, of which Coats Land forms the northern extremity, and to a comparatively steep barometric gradient between the anti-cyclone in the south and the cyclonic area to the north. The strength of the east winds in the Weddell Sea is no isolated feature in Antarctic meteorology. At Cape Adair, lat. 71° 18′ S., the heaviest gales were from the ESE. and SE, and these blew with a velocity above forty miles per hour on ninety-two days, forming 26 per cent. of the whole number of observations (see *Antarctic Manual*, p. 54). At the winter station of the *Gauss*, lat. 66° 02′ S., long. 89° 38′ E., 73 per cent. of the winds experienced were from the east, and 99 per cent. of the strong winds were from this quarter.[1] Frequent and strong winds from an easterly direction were also observed at the winter quarters of the *Discovery* and during the drift of the *Belgica*. The accumulated observations thus go far to support the supposition advanced by Dr. Supan (see *Meteorologische Zeitschrift*, vol. xvii. pf. 220-3) that the most northern extension as well as the greatest mass of the Antarctic

[1] W. Meinardus: *Ueber die Windverhältnisse an der Winterstation des* Gauss. Berlin, 1905.

TABLE III.—Showing the Departure from the Average of Mean Values of the Climatic Elements in the Weddell Sea, with different winds South of 60° S. during the cruises of the *Scotia* in 1903-1904.

1903

	N.	NNW.	NW.	WNW.	W.	WSW.	SW.	SSW.	S.	SSE.	SE.	ESE.	E.	ENE.	NE.	NNE.	C.	Mean.
Pressure, . .	·141	·006	*·188*	·010	*·069*	*·063*	·004	·245	·086	*·130*	*·245*	*·265*	*·191*	·145	·066	·141	·079	29·044
Temperature, .	2·1	2·6	2·2	*0·0*	*1·4*	*0·2*	0·2	*4·2*	*4·2*	*3·1*	*2·0*	0·4	1·1	1·5	0·5	1·2	*1·9*	26·8
Humidity, . .	*1·1*	3·7	2·6	*1·9*	*2·9*	*3·1*	*3·6*	3·0	*1·8*	1·8	0·8	*0·3*	*1·4*	*4·4*	0·9	2·1	*3·6*	82·9
Vapour Pressure, .	·009	·022	·015	*·004*	*·012*	·016	*·004*	*·016*	*·022*	*·014*	*·011*	·001	·003	*·000*	*·002*	·009	*·014*	·123
Cloud, . . .	0·4	0·3	0·4	*0·2*	*1·0*	*0·7*	*0·5*	*0·1*	*0·7*	*0·0*	*0·0*	0·1	0·6	0·2	0·3	0·4	*1·3*	9·4
Wind Force, . .	*0·3*	*0·5*	*0·2*	*0·1*	1·1	*0·2*	*0·6*	*0·5*	*0·2*	0·4	*0·0*	0·3	1·2	*0·1*	0·2	*0·4*	...	2·4
Wind Direction, .	4·4	*0·2*	0·6	*3·7*	*0·3*	*2·1*	2·0	*2·8*	0·9	*2·9*	*0·4*	*1·7*	*0·8*	*1·7*	7·5	1·2	*0·5*	...

1904

Pressure, . .	*·180*	*·130*	*·026*	*·015*	·180	·316	*·181*	*·025*	·347	·243	·156	*·050*	*·083*	*·198*	*·003*	*·173*	·299	28·960
Temperature, .	3·0	2·6	0·6	*0·6*	3·0	*1·4*	0·4	*3·7*	*5·1*	0·1	1·7	*0·7*	*2·4*	*2·6*	0·2	2·2	*4·0*	25·7
Humidity, . .	8·1	8·4	3·5	5·1	3·3	*23·7*	*13·5*	*19·5*	*5·7*	*4·1*	*2·0*	*1·7*	4·8	9·2	4·2	9·8	*3·9*	82·7
Vapour Pressure, .	·018	·024	·006	·004	·018	*·033*	*·012*	*·035*	*·029*	*·006*	·002	*·012*	*·009*	*·013*	·018	·024	*·035*	·118
Cloud, . . .	0·8	1·0	0·4	0·8	0·6	*1·1*	*0·7*	*0·7*	*2·3*	*2·0*	*0·3*	0·2	*0·0*	0·9	*0·4*	0·8	*1·8*	8·7
Wind Force, . .	0·3	0·4	*0·0*	0·5	*0·1*	*0·2*	*0·2*	*0·1*	*2·0*	*1·4*	*1·3*	0·2	0·7	1·3	*0·7*	0·3	...	2·6
Wind Direction, .	4·5	*1·5*	5·1	*1·2*	5·0	*2·5*	4·8	*2·0*	*1·7*	*3·7*	*2·2*	*4·1*	0·9	0·6	0·8	*3·2*	*0·2*	...

1903-1904

Pressure, . .	·005	*·034*	*·011*	*·023*	·060	·089	*·098*	·091	·175	·003	*·106*	*·192*	*·244*	*·043*	·061	·090	·172	29·009
Temperature, .	2·5	2·6	1·1	*0·7*	0·9	*0·7*	0·1	*4·1*	*4·4*	*2·0*	*0·8*	0·8	*0·7*	*0·7*	0·5	1·6	*2·9*	26·4
Humidity, . .	2·8	5·4	3·1	1·9	0·7	*11·1*	*8·5*	*7·3*	*3·3*	*0·2*	*0·1*	*0·4*	1·6	2·7	1·9	3·8	*3·7*	82·8
Vapour Pressure, .	·017	·023	·010	*·000*	·005	*·003*	*·008*	*·025*	*·024*	*·011*	*·006*	*·001*	*·002*	*·008*	·007	·014	*·023*	·121
Cloud, . . .	0·6	0·6	0·3	0·2	*0·3*	*0·8*	*0·6*	*0·4*	*1·1*	*0·6*	*0·1*	0·2	0·3	0·5	0·3	0·6	*1·6*	9·1
Wind Force, . .	*0·0*	*0·2*	*0·1*	0·3	0·5	*0·2*	*0·4*	*0·3*	*0·8*	*0·3*	*0·4*	0·2	1·0	0·7	*0·1*	*0·2*	...	2·5
Wind Direction, .	4·4	*0·8*	2·5	*2·7*	1·9	*2·3*	3·2	*2·4*	*0·2*	*3·2*	*1·1*	*2·7*	*0·1*	*0·7*	4·7	*0·6*	*0·4*	...

Note.—The heavy figures indicate above the average and the italic figures below the average.

Continent is in the eastern hemisphere, but probably extending much further west than he indicates. Indeed the discovery of Coats Land and the soundings taken by the *Scotia* further east affords proof of the existence of land masses extending from Coats Land to Enderby Land. The remarkable persistence of easterly winds at the winter quarters of the *Gauss* indicates that the centres of cyclonic systems are located several degrees further north on this meridian than in the Weddell Sea area. This point will doubtless be elucidated when the daily synoptic charts are completed.

Mean Hourly Values.

Tables IV. and V. show mean hourly values of pressure, temperature, cloud and wind force, recorded during each month from February 1903 to January 1904, and in March and April 1904. For the ten months April 1903 to January 1904 the data refer to the observations taken at Scotia Bay, Laurie Island, South Orkneys. The means for February 1904 at this station, being incomplete, are not included, but a full report for the whole of 1904 is being published by the Argentine Meteorological Office. In February and March 1903 and in March 1904 the observations were taken on the *Scotia* during the cruise in the Weddell Sea, and in April 1904 in the South Atlantic. The mean hourly values given are the simple arithmetical means of the observations, to which is added a twenty-fifth hour, viz. "the previous midnight," in order to eliminate any distortion of the curves due to a general rise or fall that may have taken place during the whole day. In Tables VI. and VII., which show the departure of each hourly value from the mean of the whole day, the corrections thus introduced are given effect to, and the values have been smoothed by continuous three-hour groups. Thus the mean departure for 2 A.M. for any month is the mean of the departures at 1, 2, and 3 A.M., that at 3 A.M. the mean of 2, 3, and 4 A.M., and so on for each hour of the day.

Diurnal Range in the Weddell Sea.

The diurnal range of the climatic elements in the Weddell Sea, some of which are graphically shown in the plate, Figs. 8 to 11, is very small. Dealing first with the pressure, it will be seen that the characteristic features of the diurnal pressure curve for February 1903 were a strongly pronounced morning minimum at 5 A.M., and an irregularly defined maximum spread over the afternoon and early evening. In March 1903 we have the evening maximum emphasised and the afternoon minimum clearly defined, while the morning minimum is absent. In March 1904 the morning minimum is clearly marked at 5 A.M., but from 9 A.M to 7 P.M. the values are above the mean of the day, although a very slight fall is apparent at 3 and 4 P.M. It is evident from an examination of the hourly barometric observations for ten-day periods that, in order to get an approximation towards the true diurnal period in high southern latitudes, it will be necessary to eliminate all days containing a barometric minimum. Indeed, for short periods, the curves

TABLE IV.—Showing Mean Hourly Values of Pressure, Temperature, Amount of Cloud and Wind Force at Laurie Island, S. Orkneys, Lat. 60° 44′ S., Long. 44′ 50° W. from April 1903 to January 1904.

Barometric Pressure at 32° and Mean Sea Level.

1903.	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
April, . .	29·208	·205	·203	·198	·192	·193	·191	·191	·201	·203	·200	·193	·194	·194	·193	·192	·200	·211	·218	·223	·225	·226	·217	·216	·208	29·204
May, . .	29·298	·292	·294	·295	·299	·307	·313	·319	·334	·345	·349	·352	·351	·356	·352	·353	·352	·351	·346	·341	·336	·330	·317	·312	·306	29·329
June, . .	29·256	·253	·252	·250	·243	·243	·244	·244	·256	·259	·262	·266	·265	·265	·259	·253	·253	·260	·260	·259	·263	·260	·256	·254	·250	29·256
July, . .	29·181	·178	·172	·161	·143	·135	·126	·124	·129	·133	·130	·130	·136	·146	·144	·153	·169	·182	·186	·194	·197	·196	·195	·196	·191	29·160
August, . .	29·287	·282	·279	·276	·267	·261	·262	·267	·277	·281	·282	·286	·285	·291	·289	·291	·292	·299	·305	·305	·307	·305	·295	·290	·288	29·286
September, .	29·259	·257	·253	·251	·247	·243	·246	·244	·241	·243	·240	·237	·233	·230	·227	·222	·222	·225	·226	·231	·234	·241	·244	·242	·243	29·239
October, . .	29·336	·336	·338	·340	·345	·347	·350	·356	·355	·355	·353	·351	·347	·344	·338	·331	·329	·325	·326	·329	·331	·332	·329	·331	·331	29·340
November, .	29·123	·119	·113	·112	·117	·113	·112	·111	·113	·113	·112	·112	·113	·121	·122	·122	·119	·122	·122	·125	·128	·127	·128	·127	·124	29·119
December, .	29·201	·199	·198	·198	·203	·203	·205	·201	·202	·197	·195	·190	·189	·189	·190	·190	·193	·196	·204	·211	·212	·212	·210	·208	·204	29·200
January, . .	29·153	·145	·136	·135	·135	·139	·140	·141	·142	·143	·143	·145	·150	·159	·164	·167	·171	·179	·186	·187	·182	·183	·177	·173	·167	29·158
Mean	29.230	·227	·224	·223	·219	·218	·219	·220	·225	·227	·227	·226	·227	·230	·228	·227	·230	·235	·238	·240	·242	·241	·237	·235	·231	29·229

Mean Air Temperature.

1903.	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
April, . .	20·6	20·7	20·6	20·8	21·0	20·6	20·3	20·5	20·5	20·7	21·1	21·2	21·2	21·2	21·2	21·1	20·6	20·4	19·6	19·6	19·7	20·1	20·4	20·2	20·4	20·6
May, . .	16·6	17·2	17·3	17·5	17·8	17·8	17·9	17·8	17·3	17·4	17·0	17·2	17·3	17·0	16·8	16·1	15·9	16·4	16·5	16·3	16·4	16·8	17·4	17·4	17·6	17·1
June, . .	9·5	10·2	10·0	10·4	10·1	9·8	9·8	9·1	9·2	8·7	8·5	9·3	9·4	9·5	9·1	9·1	9·2	9·0	9·4	9·8	9·9	9·9	9·5	8·9	9·3	9·5
July, . .	16·4	16·3	16·8	17·9	18·3	18·5	18·9	18·9	18·4	18·5	18·9	18·8	18·2	17·9	17·0	16·1	15·2	14·9	15·1	15·3	15·3	15·4	15·1	15·2	15·3	16·9
August, . .	18·9	19·0	19·1	19·1	19·2	19·1	18·6	18·2	18·0	17·9	18·3	18·9	19·1	19·3	19·0	18·9	18·4	17·9	17·6	17·6	17·7	18·1	18·1	18·6	19·0	18·6
September, .	12·2	11·8	12·2	12·0	11·8	11·6	11·9	12·4	13·2	13·7	13·9	14·2	14·7	15·3	15·6	15·6	15·1	14·4	13·6	13·3	13·2	13·0	12·8	13·1	13·1	13·4
October, . .	26·6	26·0	25·5	25·2	25·2	25·8	25·9	26·2	26·8	27·4	27·8	28·0	28·1	28·3	28·6	28·3	28·1	27·8	27·4	27·2	26·9	26·8	26·6	26·7	26·6	27·0
November, .	28·5	28·2	28·1	28·1	28·2	28·4	28·7	29·0	29·2	29·6	30·1	30·3	30·5	30·7	30·4	30·5	30·4	29·9	29·6	29·5	29·4	29·3	29·0	28·4	28·3	29·3
December, .	30·5	30·3	30·4	30·3	30·4	30·6	30·9	31·4	31·7	32·0	32·1	32·1	32·9	32·9	32·8	32·5	32·2	32·1	31·8	31·5	31·4	31·2	30·8	30·9	30·7	31·5
January, . .	31·4	31·4	32·0	32·0	32·1	32·1	32·0	32·1	32·4	32·5	32·8	33·1	33·2	33·2	33·0	33·0	33·1	32·5	32·4	32·2	31·9	31·6	31·4	31·5	31·3	32·3
Mean	20·6	21·1	21·2	21·3	21·4	21·4	21·5	21·6	21·7	21·8	22·0	22·3	22·5	22·5	22·4	22·1	21·8	21·5	21·3	21·2	21·2	21·2	21·1	21·1	21·2	21·6

Mean Amount of Cloud—Scale 0-10.

1903.	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
April,	8·4	7·7	6·6	6·4	7·4	7·9	8·0	7·9	8·4	8·5	8·2	8·1	8·3	8·6	8·9	9·5	9·2	9·4	8·3	8·1	8·4	7·7	7·8	7·5	8·4	8·1
May,	7·8	7·4	7·8	7·1	7·6	7·5	7·3	8·1	8·4	8·6	8·3	7·3	7·4	7·5	7·3	7·5	7·4	7·4	7·1	6·7	6·9	6·7	7·3	7·6	7·8	7·5
June,	7·1	5·8	5·8	5·8	6·5	6·7	6·2	5·9	6·9	7·2	7·0	6·9	6·1	6·5	6·7	7·0	6·9	7·0	7·4	7·6	7·2	6·8	6·9	7·6	7·0	6·7
July,	7·3	7·6	7·6	7·1	7·6	7·0	7·6	8·1	7·8	7·9	8·4	8·3	8·3	8·2	7·1	7·1	7·8	7·2	6·4	6·9	7·4	7·0	7·2	7·5	7·5	7·5
August,	7·6	8·4	8·7	8·9	8·4	8·4	8·1	8·5	8·2	7·9	7·8	7·7	7·8	7·9	7·8	8·0	8·2	8·5	8·0	7·9	8·0	8·1	7·9	8·0	7·7	8·1
September,	6·1	6·4	6·2	6·5	6·6	6·7	6·7	6·8	7·4	7·3	7·2	7·5	7·8	7·8	7·6	7·3	7·2	7·5	7·3	7·1	6·8	6·5	7·1	6·5	6·1	7·0
October,	7·6	7·4	7·3	7·5	8·3	8·3	8·6	8·4	7·9	8·4	8·2	8·6	8·6	9·1	9·0	9·1	9·1	9·1	9·5	9·3	8·8	8·5	7·6	7·9	7·6	8·4
November,	8·3	8·4	8·4	8·0	8·8	9·5	9·6	9·1	9·1	8·5	8·7	8·3	8·5	8·9	8·6	8·3	7·7	7·9	7·6	7·8	7·6	7·5	8·5	8·8	8·3	8·4
December,	9·5	9·7	9·9	9·7	9·3	9·1	9·0	8·9	9·6	9·2	9·2	8·7	8·6	8·7	8·9	9·1	9·1	9·3	9·6	9·5	9·6	9·6	9·8	9·4	9·5	9·3
January,	9·6	9·5	9·7	9·6	9·4	9·4	9·6	9·5	9·3	9·4	9·3	9·5	9·7	9·7	9·5	9·8	9·6	9·7	9·8	9·5	9·4	9·5	9·8	9·7	9·6	9·6
Mean,	7·9	7·8	7·8	7·7	8·0	8·0	8·1	8·2	8·3	8·3	8·2	8·1	8·1	8·3	8·2	8·3	8·2	8·3	8·1	8·0	8·0	7·8	8·0	8·1	8·0	8·1

Mean Wind Force—Scale 0-12.

1903.	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
April,	1·57	1·67	1·82	1·73	2·03	1·90	2·08	2·12	1·80	1·72	1·63	1·65	1·78	1·57	1·77	1·47	1·42	1·52	1·27	1·35	1·58	1·48	1·30	1·43	1·57	1·65
May,	2·23	2·37	2·22	2·21	2·29	2·66	2·65	2·55	2·13	2·00	2·15	1·77	1·85	2·18	2·16	1·92	2·03	2·05	2·27	2·32	2·61	2·13	2·16	2·07	2·31	2·21
June,	1·57	1·62	1·68	1·72	2·40	1·98	2·12	2·37	1·90	1·78	1·57	1·82	2·00	1·65	1·83	1·67	1·45	1·58	1·43	1·40	1·30	1·30	1·35	1·15	1·48	1·70
July,	2·48	2·56	2·76	2·66	3·05	2·73	2·65	2·90	2·16	2·19	2·27	2·32	2·07	2·13	2·02	1·97	1·87	1·87	2·13	2·24	2·32	2·32	2·37	2·34	2·50	2·35
August,	2·05	2·05	2·05	1·95	2·65	2·65	2·63	2·44	2·26	1·95	1·92	2·15	2·13	1·79	1·86	1·94	1·98	1·89	1·82	1·76	1·88	1·78	1·71	1·82	2·02	2·05
September,	1·82	1·53	1·80	1·27	1·58	1·62	1·33	1·63	1·47	1·48	1·52	1·67	1·93	1·75	1·70	1·80	1·82	1·63	1·72	1·78	1·77	1·78	1·67	1·73	1·85	1·66
October,	1·50	1·73	1·73	1·65	1·65	2·15	2·10	2·10	2·18	2·21	2·15	2·10	2·00	2·27	2·03	2·11	2·24	2·32	2·36	1·94	1·98	1·73	1·73	1·85	1·66	2·00
November,	1·90	1·87	1·93	1·88	1·68	1·63	1·62	1·78	1·65	1·67	1·57	1·63	1·58	1·75	1·62	1·63	1·62	1·53	1·57	1·53	1·52	1·60	1·67	1·63	1·82	1·66
December,	1·35	1·42	1·35	1·16	1·08	1·23	1·26	1·41	1·32	1·27	1·24	1·32	1·26	1·23	1·22	1·15	1·24	1·31	1·24	1·24	1·40	1·37	1·27	1·27	1·35	1·27
January,	1·23	0·77	1·16	1·07	1·02	0·98	1·08	1·05	1·10	1·13	1·03	0·79	1·18	1·23	1·40	1·29	1·20	1·13	0·92	0·84	0·97	1·11	0·98	1·13	1·16	1·08
Mean,	1·77	1·76	1·85	1·73	1·94	1·95	1·95	2·02	1·81	1·74	1·71	1·71	1·78	1·76	1·76	1·70	1·68	1·68	1·68	1·64	1·73	1·66	1·62	1·67	1·77	1·76

TABLE V.—Showing Mean Hourly Values of Pressure, Temperature, Amount of Cloud, Wind Force, Relative Humidity, and Vapour Pressure in the Weddell Sea during February and March 1903 and March 1904, and in the South Atlantic in April 1904.

Barometric Pressure at 32° and Sea Level.

	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.	Range.
1903	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	
February,	29·075	·073	·069	·065	·053	·056	·062	·066	·066	·068	·074	·078	·081	·087	·084	·083	·085	·086	·088	·087	·088	·086	·085	·083	·077	29·076	..
March, .	29·000	·999	·999	·998	·992	·990	·990	·993	·989	·994	·991	·987	·978	·986	·981	·980	·981	·984	·987	·991	·995	·996	·996		·995	28·989	..
1904																											
March, .	29·026	·025	·022	·019	·013	·010	·011	·012	·012	·012	·015	·013	·011	·014	·010	·008	·006	·007	·007	·005	·995	·996	99	997	·996	29·009	..
April, .	29·517	·514	·509	·508	·499	·501	·503	·513	·538	·547	·552	·556	·554	·534	·528	·524	·528	·531	·529	·543	·554	·558	·568	569	·567	29·535	..

Mean Air Temperature.

	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.	Range.
1903	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
February, .	27·6	27·4	27·4	27·2	27·2	27·1	27·3	27·4	27·8	27·8	27·9	28·1	28·2	28·5	28·6	28·6	28·6	28·5	28·3	28·1	27·8	27·7	27·5	27·4	27·3	27·8	1·5
March, .	25·2	25·2	25·1	25·1	25·0	24·9	25·0	25·0	25·0	25·2	25·1	25·2	25·2	25·2	25·2	25·3	25·2	25·2	25·0	24·8	24·8	24·8	24·7	24·8	24·7	25·0	0·6
1904																											
March, .	24·5	24·1	24·2	24·4	24·3	24·2	24·6	24·9	25·3	25·5	25·5	25·7	25·9	26·0	25·9	25·6	25·5	25·4	25·3	25·1	24·9	24·7	24·8	24·5	24·6	25·0	1·9
April, .	43·1	42·8	42·8	42·8	42·7	42·7	42·7	42·8	42·8	43·0	43·2	43·4	43·8	43·8	43·9	43·8	43·8	43·7	43·8	43·9	43·5	43·4	43·5	43·5	43·6	43·3	1·2

Mean Amount of Cloud 0-10.

	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.	Range.
1903																											
February, .	9·5	9·3	9·4	9·2	9·0	9·0	9·1	9·2	9·2	9·0	9·3	9·2	9·5	9·2	8·7	8·7	8·4	8·4	9·1	8·7	9·1	8·9	9·4	9·2	9·5	9·1	..
March, .	9·0	9·4	9·4	9·8	9·8	9·6	9·8	9·1	9·6	9·3	9·1	9·2	9·4	9·8	9·9	9·9	9·8	9·7	9·9	9·9	9·7	9·4	8·9	9·4	9·0	9·5	..
1904																											
March, .	8·3	7·5	7·9	8·2	8·2	8·4	8·4	8·6	8·8	9·1	9·3	9·4	9·2	9·1	9·2	9·0	9·2	9·0	9·2	9·4	9·1	8·7	9·0	8·0	8·3	8·8	..
April, .	7·7	7·7	7·4	7·4	6·9	7·3	7·4	7·1	7·9	8·2	7·7	8·0	7·1	7·6	7·6	8·4	8·2	7·9	7·7	7·4	7·4	7·7	8·4	7·9	7·7	7·7	..

are so distorted that the adjustment for midnight differences utterly fails to get rid of the larger variations due to the irregular occurrence of barometric minima, which may take place at any hour of the day.

Temperature.

The diurnal range of temperature in the three months under review is well marked, the values being above the mean from about 9 A.M. to 9 P.M., and below the mean during the other half of the twenty-four hours. It is interesting to compare the curves during the very cloudy March of 1903 and the relatively clear March of 1904. In March 1903 the difference between the coldest and warmest hours was only 0·6°, but in March 1904 the difference was 1·9°, this comparatively large difference being largely due to the Continental influence exerted by the proximity of Coats Land, especially during the ten days March 11 to 20, when the difference between the coldest hour, 1 A.M., and the warmest, 1 P.M., was 4·5°. The diurnal period in the amount of cloud for the three months is somewhat irregular, but there is a decided tendency for a maximum in the afternoon, which is well marked in the Marches of 1903 and 1904. In February 1903, on the other hand, the minimum took place at this time, but in this month the diurnal period is very ill-defined. Of all the elements of climate in high southern latitudes the diurnal variation in the amount of cloud is the most irregular.

The force of the wind shows a distinct daily period in each of the three months under review, the values being below the mean during the time the sun was above the horizon, and above the mean when he was below the horizon, and the curves showing the mean relative humidity exhibit practically the same period. Vapour pressure, on the other hand, shows no defined variation through the hours of the day. For April 1904, when the *Scotia* was in the South Atlantic between 60° and 40° South latitude, the diurnal period in most of the elements is well defined. As regards pressure, we have the double maximum and minimum well marked. The morning minimum occurs at 5 A.M., after which pressure increases till 11 A.M. The afternoon minimum is clearly seen at 5 P.M., and the evening maximum at 11 P.M. Temperature is above the mean from 10 A.M. to 8 P.M. The difference between the warmest and coldest hours in this month was only 1·2°, being thus considerably smaller than that recorded in much higher latitudes during the previous month. The distribution of the amount of cloud through the hours of the day is again irregular, the most conspicuous features being a minimum in the early morning and a maximum in the afternoon. The force of the wind shows a minimum about 7 A.M. and a maximum at 10 P.M., the period below the mean strength for the whole day being spread over the sixteen hours ending with 6 P.M., while there is a pronounced maximum from 6 P.M. to 2 A.M. The curve of relative humidity shows a similar daily period, except that the minimum is recorded at 11 A.M. The vapour pressure shows a well-pronounced morning minimum, and a secondary very small minimum at about 6 P.M., while there are two maxima, one about 3 P.M. and the other at 10 P.M.

TABLE V.—*Continued.*

Mean Wind Force—0-12

	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
1903																										
February, .	1·93	1·93	1·98	1·89	2·02	2·00	1·95	2·02	1·39	1·59	1·54	1·61	1·73	1·82	1·62	1·71	1·61	1·80	1·77	1·71	1·82	1·88	2·04	1·96	1·91	1·80
March, . .	3·06	2·92	2·68	2·58	2·29	2·23	2·23	2·48	2·02	2·19	2·16	2·39	2·27	2·56	2·47	2·68	2·56	2·69	2·63	2·60	2·82	2·77	2·76	2·79	3·03	2·53
1904																										
March, . .	2·77	2·85	2·85	2·82	2·66	2·71	2·68	2·58	2·60	2·65	2·50	2·60	2·63	2·55	2·53	2·68	2·73	2·74	2·79	2·94	3·05	2·87	2·90	3·14	3·08	2·76
April, . .	4·27	4·23	4·05	3·95	3·75	4·00	3·70	3·73	3·70	3·77	3·83	3·78	3·73	3·67	3·80	4·00	3·85	3·63	3·83	4·02	3·97	4·10	4·10	4·07	4·03	3·89

Mean Relative Humidity Saturation = 100

	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
1903																										
February, .	84·8	85·1	85·2	86·4	85·9	85·4	83·9	83·8	82·9	81·2	80·1	81·2	80·9	81·0	81·6	81·0	80·5	80·0	79·5	80·9	82·6	82·6	83·8	83·9	83·9	82·6
March, . .	83·6	83·1	82·4	82·6	84·2	83·7	83·0	83·8	84·9	84·6	83·6	82·9	80·3	81·1	80·8	81·1	81·9	81·3	84·6	83·1	83·4	82·7	84·4	84·1	84·5	83·0
1904																										
March, . .	84·2	85·0	83·1	82·9	83·4	85·3	82·5	82·1	80·9	82·1	82·9	81·0	83·1	82·0	81·9	84·2	83·4	83·9	84·2	85·6	85·3	87·5	85·8	86·5	84·9	83·7
April, . .	87·7	86·6	88·6	87·8	87·8	86·1	86·4	85·7	85·2	85·3	84·7	84·0	84·7	85·5	85·9	85·9	87·0	86·4	84·6	84·8	86·9	88·3	88·4	87·2	87·2	86·4

Mean Vapour Pressure.

	Mdt.	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
1903																										
February, .	·130	·130	·130	·130	·130	·128	·128	·129	·128	·127	·125	·128	·129	·130	·131	·131	·130	·129	·126	·127	·128	·126	·127	·128	·127	·128
March, . .	·116	·116	·114	·114	·116	·115	·114	·115	·117	·118	·116	·115	·113	·113	·113	·114	·114	·113	·116	·113	·113	·113	·115	·115	·115	·115
1904																										
March, . .	·115	·116	·115	·115	·116	·119	·115	·117	·115	·117	·118	·117	·120	·119	·118	·121	·120	·120	·119	·119	·118	·120	·118	·115	·117	·118
April, . .	·252	·250	·254	·249	·248	·244	·245	·244	·243	·245	·246	·247	·251	·253	·256	·256	·259	·256	·253	·253	·257	·257	·260	·256	·259	·252

South Orkneys.

Figure 12 shows the diurnal period of pressure, temperature, cloud, and wind force at Laurie Island, South Orkneys, latitude 60° 44′ S., long. 44° 50′ W., for the ten months, April 1903 to January 1904. Details for each month in this period will be found in the tables.

The pressure curve for the period under review shows a well-marked morning minimum at 5 A.M., and a very small afternoon minimum at 3 P.M., the principal maximum occurring at 8 P.M. Now this closely approximates to the typical curve for insular positions, such as the Helder in the north-west of Holland and Valentia in Ireland,[1] the most conspicuous feature of which is the retardation of the morning maximum. During at least eight of the ten months discussed the South Orkneys, owing to the freezing up of the sea to the south, were virtually on the edge of a continent, and this preponderating influence might be expected to strongly influence the diurnal period of pressure. At the South Orkneys the morning maximum (a very small one) is retarded till 1 P.M., while at the Helder it is reached between 10 and 11 A.M. The diurnal range of temperature is of a simple character, the maximum occurring at 1 P.M., and the minimum from 10 P.M. to midnight. It will be observed, on looking at the tables, that the disturbing effect due to the passage of cyclones in winter is so great that during this season the nights were warmer than the days. This must be looked upon as purely accidental, and will no doubt disappear when the three years' data (for two years of which we are indebted to the energy of the Argentine Meteorological Office) are discussed. From September to January the solar effect is well marked, the morning minimum and the midday maximum being well pronounced. As regards cloud, the diurnal period shows a slight maximum spread over the twelve hours, 6 A.M. to 6 P.M., and a minimum during the other twelve hours which is most pronounced at about 3 A.M. The force of the wind is greatest from 4 to 8 A.M., and least from 4 to 11 P.M. As regards the daily period of relative humidity and vapour pressure, the values for the winter have not yet been computed, but for the three summer months, November to January, both curves closely correspond to the temperature curve for this season, viz. the greatest relative humidity and the lowest vapour pressure occur in the early morning at the time of lowest mean temperature; and the least humidity and greatest vapour pressure occur in the early afternoon during the warmest hours of the day. The difference between the hourly values of relative humidity show an extreme variation of only 3·5 per cent., while in the vapour pressure the range is only 0·009 inch.

Falkland Islands.

During the visit of the *Scotia* to Port Stanley, Falkland Islands, in January 1903, a barograph was left at Cape Pembroke Lighthouse,

[1] See *Challenger Reports.* Physics and Chemistry, vol. ii.: Report on Atmospheric Circulation, by Dr. Buchan, pp. 12, 13.

TABLE VI.—Showing the Smoothed Departure from the Mean of Hourly Values of Pressure, Temperature, Cloud, Wind Force, Relative Humidity, and Vapour Pressure in the Weddell Sea and South Atlantic.

Barometric Pressure, Thousandths of an Inch.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
1903																									
February, .	2	6	13	17	18	13	11	9	7	3	2	6	8	9	8	9	9	9	10	10	9	8	5	2	29·076 ins.
March, . .	8	8	5	2	0	1	1	2	1	1	4	5	7	6	8	6	4	0	4	7	9	9	9	9	28·989 ,,
1904																									
March, . .	1	0	3	6	7	6	4	3	0	1	2	3	3	4	2	2	3	4	1	1	2	0	1	1	29·009 ,,
April, . .	2	3	10	13	18	16	6	7	18	22	22	13	3	9	13	14	15	12	7	1	7	10	11	8	29·535 ,,

Temperature, Tenths of Degrees F.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	
1903																									
February, .	5	6	6	7	7	6	4	2	0	1	3	5	6	8	8	8	7	6	4	1	0	2	3	4	27°8
March, . .	1	1	1	2	2	2	1	0	0	1	1	2	2	3	3	3	2	1	0	0	0	0	1	0	25·0
1904																									
March, . .	7	8	7	7	6	4	1	2	4	6	7	9	9	8	7	5	4	2	1	1	1	2	3	5	25·0
April, . .	1	1	2	3	3	3	3	3	2	0	2	4	5	5	4	3	3	3	2	0	1	2	1	1	43·3

Cloud, Per Cent.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	
1903																									
February, .	3	2	1	0	1	0	1	0	1	1	2	2	0	2	5	6	5	4	1	2	0	1	3	2	9°1
March, . .	2	0	2	2	2	0	0	2	2	3	3	0	2	4	4	3	3	3	3	2	2	3	4	2	9·5
1904																									
March, . .	9	9	7	5	5	3	2	0	3	5	5	4	4	3	3	3	3	4	4	3	1	2	4	9	8·8
April, . .	1	2	5	5	5	4	2	0	2	3	1	1	3	2	4	5	2	0	2	2	1	3	3	1	7·7

Wind Force.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	
1903																									
February, .	**·14**	**·12**	**·15**	**·16**	**·18**	**·18**	*·02*	*·13*	*·29*	*·22*	*·17*	*·08*	*·08*	*·09*	*·15*	*·09*	*·07*	*·04*	*·03*	**·01**	**·12**	**·17**	**·18**	**·14**	1°80
March, .	**·34**	**·20**	*·02*	*·17*	*·29*	*·23*	*·30*	*·31*	*·41*	*·28*	*·29*	*·16*	*·13*	**·04**	**·04**	**·12**	**·10**	**·12**	**·16**	**·21**	**·26**	**·25**	**·34**	**·39**	2·53
1904																									
March, . .	**·21**	**·22**	**·14**	**·08**	**·02**	*·02*	*·07*	*·09*	*·13*	*·14*	*·16*	*·16*	*·20*	*·19*	*·15*	*·09*	*·07*	*·01*	**·08**	**·10**	**·07**	**·09**	**·14**	**·22**	2·76
April, . .	**·18**	**·08**	*·07*	*·08*	*·15*	*·15*	*·24*	*·21*	*·16*	*·13*	*·13*	*·17*	*·15*	*·05*	**·02**	*·02*	*·07*	*·00*	**·12**	**·22**	**·26**	**·30**	**·29**	**·26**	3·89

Relative Humidity, Per Cent.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	
1903																									
February, .	**22**	**29**	**30**	**30**	**22**	**15**	**7**	*1*	*13*	*19*	*19*	*16*	*14*	*13*	*15*	*20*	*24*	*23*	*14*	*3*	**7**	**12**	**17**	**18**	82°6
March, . .	**5**	**1**	**4**	**8**	**9**	**7**	**11**	**16**	**12**	**8**	*7*	*15*	*23*	*21*	*18*	*17*	*6*	*2*	**5**	*2*	**2**	**4**	**9**	**8**	83·0
1904																									
March, . .	**9**	**3**	*3*	**4**	**2**	*2*	*17*	*19*	*16*	*16*	*13*	*17*	*14*	*10*	*5*	**1**	**1**	**10**	**15**	**26**	**27**	**32**	**23**	**21**	83·7
April, . .	**11**	**12**	**16**	**7**	**3**	*4*	*6*	*10*	*13*	*17*	*19*	*16*	*9*	*5*	*0*	**2**	*2*	*9*	*7*	**5**	**18**	**19**	**15**	**8**	86·4

Vapour Pressure, Thousandths of an Inch.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	
1903																									
February, .	**1**	**1**	**1**	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*1*	**1**	**2**	**3**	**3**	**2**	**1**	*0*	*0*	*0*	*0*	*0*	*0*	**1**	·128 ins.
March . .	*0*	*1*	*0*	*0*	*0*	*0*	*0*	**2**	**2**	**1**	*0*	*1*	*2*	*2*	*1*	*1*	*1*	*1*	*1*	*2*	*1*	*1*	*0*	*0*	·115 ,,
1904																									
March, . .	*2*	*2*	*2*	*0*	*0*	*0*	*2*	*2*	*1*	*1*	*0*	**1**	**1**	**1**	**2**	**2**	**2**	**1**	*0*	*0*	*0*	*1*	*2*	*2*	·118 ,,
April, . .	**3**	**2**	**1**	*2*	*4*	*6*	*6*	*7*	*6*	*5*	*4*	*2*	**1**	**3**	**4**	**4**	**3**	*0*	*0*	**2**	**3**	**3**	**3**	**2**	·252 ,,

Note.—The heavy figures indicate above the average and the italic figures below the average.

TABLE VII.—Showing the Smoothed Departure from the Mean of Hourly Values of Pressure, Temperature, Cloud, and Wind Force at the South Orkneys from April 1903 to January 1904.

Barometer at 32° and Mean Sea Level. Thousands of an inch.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Midt.	Mean.
April,	1	2	6	10	11	11	9	6	3	5	8	10	10	11	9	3	9	17	21	21	19	16	10	6	29·204
May,	28	32	30	26	20	14	5	5	15	21	23	25	25	24	22	22	19	15	10	5	3	9	16	22	29·329
June,	5	6	10	13	15	14	9	4	2	6	8	9	7	3	0	0	3	5	7	7	6	3	0	2	29·256
July,	22	15	3	13	22	30	22	31	28	28	27	22	18	13	6	7	17	24	29	31	32	32	30	27	29·160
August,	3	7	9	15	19	23	17	11	6	2	1	2	2	4	5	8	13	17	20	20	16	11	5	1	29·286
September,	10	8	5	2	1	1	2	2	1	1	3	6	9	12	14	14	12	8	4	1	6	10	11	11	29·239
October,	6	4	1	2	6	10	13	14	13	12	10	7	3	2	7	11	12	12	10	8	7	7	8	7	29·340
November,	0	4	5	5	5	7	7	7	6	7	7	4	0	3	2	2	2	4	6	8	9	9	7	4	29·119
December,	1	1	1	2	5	5	5	2	2	6	9	11	11	10	9	7	3	3	8	11	10	9	6	3	29·200
January,	7	13	17	17	16	14	13	13	13	13	11	6	1	5	8	12	18	23	23	22	18	14	8	2	29·158
Period,	2	4	7	9	10	10	8	5	3	2	2	1	1	1	1	2	5	9	11	12	11	9	5	2	29·229

Temperature—Tenths of Degrees F.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Midt.	
April,	1	0	1	1	1	2	2	0	2	4	6	6	6	6	4	1	4	7	9	7	4	3	2	1	20·6
May,	4	7	8	10	11	10	8	6	4	4	3	2	1	5	9	11	10	9	10	9	6	3	1	2	17·1
June,	3	6	6	5	3	0	2	5	7	7	4	1	2	3	4	4	3	1	3	5	4	0	2	0	9·5
July,	9	4	3	0	13	16	16	15	15	17	16	13	8	2	7	13	16	15	14	12	13	12	12	11	16·9
August,	4	4	4	4	3	1	4	6	6	2	2	5	5	5	2	2	6	8	9	7	5	2	1	3	18·6
September,	9	10	10	13	14	12	7	1	3	6	9	14	18	20	19	15	8	2	3	5	7	8	8	9	13·4
October,	8	12	17	16	13	10	7	2	3	7	10	11	13	14	13	11	8	5	2	0	2	3	4	4	27·0
November,	11	13	13	12	10	7	4	0	3	7	10	12	12	12	11	10	7	4	3	2	0	3	6	10	29·3
December,	10	11	10	10	8	5	1	2	4	7	10	12	14	12	10	8	5	3	0	2	5	6	8	9	31·5
January,	7	5	3	2	2	2	1	0	3	5	7	9	8	8	7	6	4	1	1	4	7	8	9	9	32·3
Period,	4	4	3	2	2	1	0	1	2	4	7	8	9	7	5	2	1	3	4	4	4	5	5	5	21·6

NOTE.—The heavy figures indicate above the average and the italic figures below the average.

where regular meteorological observations are taken every four hours by Mr. John Pearce, the principal keeper, and his assistant. Mr. Pearce having kindly forwarded the barograph sheets for the three years 1903-1905, I am now able to give hourly values for the two years 1903 and 1904. The third year's observations, those for 1905, are at present being reduced, but the broad features of the diurnal variation of pressure are apparent from the two years' observations. In this connection I am indebted to Dr. W. N. Shaw, F.R.S., Director of the Meteorological Office, for the loan of the barograph curves since May 1904, and to Mr. James Miller (late first assistant at the Ben Nevis Observatory), for measuring and tabulating the hourly values. In the table given will be found the hourly departures of the barometric pressure for each month and the year, these values being graphically shown in the plate, Fig. 13. These values are corrected for midnight differences, but have not been smoothed in any way. The results of this inquiry have been given to afford data for study and comparison with those from the South Orkneys, Weddell Sea, and the South Atlantic, already referred to, and I propose at present merely to draw attention to some of the more pronounced features of the curves. It is seen that the morning maximum takes place at times varying from six to ten o'clock, the hour of earliest occurrence being in summer, and the hour of latest occurrence in winter. The curves for these two seasons are quite distinct. Taking January as typical of the summer, and July as illustrative of the winter type, we note the following. In January the most pronounced feature is the large morning maximum and deep afternoon minimum, while the morning minimum all but vanishes, and the evening minimum is much reduced. In July, on the other hand, the morning maximum is so small as almost wholly to disappear, while the afternoon minimum is still a salient feature of the curve, the larger maximum occurring in the evening. It is interesting to note the pronounced character of the morning minimum during the six months April to September, and how this is succeeded in summer by a decided maximum in these hours. It will further be noted how the afternoon minimum deepens in the summer as compared with the winter months. Doubtless, as more years' observations are taken, the merging of the one type into the other will be shown in a less abrupt manner, while anomalies such as that presented by the month of December will be eliminated. The smallest amplitude is in May, viz. 0·017 inch, and the largest in October, 0·038 inch. With a view of seeing how far the geographical position of the station influenced the diurnal variation of the barometer in comparatively high southern latitudes, I have examined the mean annual values from South Georgia (lat. 54° 31′ S., long. 36° 05′ W.), Orange Bay near Cape Horn (lat. 55° 31′ S., long. 68° 5′ W.), and during the drift of the *Belgica* between the latitudes of 69° 50′ and 71° 30′ S., and longitudes from 87° to 95° W., the data being obtained from the respective official accounts of the three expeditions. The results have been plotted along with those from Cape Pembroke and the South Orkneys (see plate, Fig. 14). With regard to the *Belgica*, it may be said that the diurnal range all but disappear, there being a range of only 0·007 inch between the highest and lowest mean hourly values.

TABLE VII.—*Continued.*

Cloud—Per Cent.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	Mean.
April, . .	*5*	*12*	*13*	*9*	*3*	*2*	*0*	**2**	**3**	**2**	**1**	**2**	**5**	**9**	**11**	**13**	**9**	**5**	**2**	*0*	*1*	*4*	*2*	*2*	8·1
May, . .	**2**	*1*	*0*	*1*	*0*	**1**	**4**	**9**	**9**	**6**	**2**	*1*	*1*	*1*	*1*	*1*	*2*	*4*	*6*	*7*	*5*	*3*	**1**	**1**	7·5
June, . .	*5*	*9*	*6*	*4*	*2*	*4*	*4*	*0*	**3**	**3**	*0*	*2*	*3*	*0*	**2**	**3**	**4**	**6**	**7**	**5**	**3**	**4**	**5**	**1**	6·7
July, . .	**1**	**1**	*0*	*2*	*0*	**2**	**5**	**5**	**5**	**7**	**8**	**8**	**5**	**1**	*1*	*1*	*4*	*7*	*7*	*5*	*4*	*4*	*0*	**1**	7·5
August, . .	**2**	**6**	**6**	**5**	**2**	**2**	**2**	**1**	*1*	*3*	*3*	*3*	*3*	*2*	*1*	**1**	**1**	*0*	*1*	*1*	*1*	*1*	*2*	*1*	8·1
September, .	*8*	*6*	*6*	*4*	*3*	*3*	*0*	**2**	**3**	**3**	**5**	**7**	**7**	**6**	**4**	**3**	**3**	**3**	**1**	*2*	*2*	*3*	*4*	*7*	7·0
October, . .	*10*	*10*	*7*	*4*	*0*	*0*	*1*	*2*	*2*	*0*	**1**	**4**	**5**	**7**	**7**	**7**	**8**	**8**	**8**	**5**	*1*	*4*	*7*	*8*	8·4
November, .	*0*	*1*	*0*	**4**	**9**	**10**	**9**	**5**	**4**	**1**	**1**	**2**	**3**	**2**	*2*	*4*	*7*	*7*	*8*	*8*	*5*	*1*	**1**	**1**	8·4
December, .	**4**	**5**	**3**	**1**	*2*	*3*	*1*	*1*	*0*	*3*	*5*	*6*	*6*	*4*	*2*	*0*	**1**	**2**	**3**	**3**	**4**	**3**	**3**	**2**	9·3
January, . .	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*2*	*3*	*2*	*1*	0	0	**1**	0	**1**	**1**	**1**	*0*	*1*	*0*	**1**	**1**	*0*	9·6
Period, .	*2*	*3*	*3*	*2*	*1*	*0*	**1**	**2**	**2**	**2**	*0*	**1**	**1**	**2**	**1**	**2**	**1**	*0*	*1*	*2*	*2*	*1*	*1*	*1*	8·1

Wind Force.

	1	2	3	4	5	6	7	8	9	10	11	N.	1	2	3	4	5	6	7	8	9	10	11	Mdt.	
April, . .	**·04**	**·09**	**·21**	**·27**	**·35**	**·38**	**·35**	**·23**	**·07**	**·02**	**·04**	**·02**	**·08**	*·05*	*·10*	*·18*	*·25*	*·27*	*·25*	*·18*	*·20*	*·25*	*·22*	*·09*	1·65
May, . .	**·10**	**·10**	**·07**	**·21**	**·35**	**·43**	**·25**	**·03**	*·10*	*·23*	*·28*	*·27*	*·15*	*·13*	*·18*	*·22*	*·11*	*·02*	**·17**	**·12**	**·06**	**·13**	**·07**	**·03**	2·21
June, . .	*·13*	*·06*	**·21**	**·30**	**·44**	**·43**	**·41**	**·30**	**·04**	**·01**	**·09**	**·12**	**·13**	**·02**	*·04*	*·12*	*·20*	*·21*	*·30*	*·34*	*·35*	*·30*	*·23*	*·17*	1·70
July, . .	**·26**	**·33**	**·48**	**·47**	**·47**	**·42**	**·22**	**·07**	*·14*	*·09*	*·13*	*·18*	*·18*	*·31*	*·39*	*·44*	*·39*	*·24*	*·13*	*·07*	*·02*	*·02*	**·04**	**·11**	2·35
August, . .	*·01*	*·04*	**·16**	**·36**	**·58**	**·51**	**·38**	**·16**	*·01*	*·04*	**·02**	*·03*	*·12*	*·19*	*·14*	*·11*	*·15*	*·22*	*·22*	*·23*	*·25*	*·27*	*·19*	*·08*	2·05
September, .	**·07**	*·12*	*·10*	*·16*	*·13*	*·12*	*·17*	*·13*	*·17*	*·10*	**·05**	**·12**	**·13**	**·09**	**·11**	**·09**	**·06**	**·04**	**·09**	**·11**	**·07**	**·06**	**·08**	**·04**	1·66
October, . .	*·27*	*·23*	*·26*	*·13*	**·02**	**·17**	**·16**	**·19**	**·20**	**·17**	**·09**	**·13**	**·10**	**·13**	**·11**	**·20**	**·28**	**·17**	**·05**	*·17*	*·24*	*·29*	*·32*	*·28*	2·00
November, .	**·20**	**·20**	**·14**	**·04**	*·07*	*·01*	*·00*	**·02**	*·04*	*·05*	*·07*	*·02*	*·01*	**·01**	*·03*	*·05*	*·07*	*·10*	*·10*	*·08*	*·03*	**·01**	**·09**	**·13**	1·66
December, .	**·10**	**·04**	*·07*	*·11*	*·12*	*·03*	**·04**	**·07**	**·07**	**·01**	**·01**	*·00*	*·00*	*·03*	*·07*	*·07*	*·04*	*·01*	**·05**	**·06**	**·07**	**·03**	**·03**	**·08**	1·27
January, . .	*·05*	*·10*	*·02*	*·08*	*·07*	*·06*	*·02*	*·00*	*·00*	*·10*	*·08*	*·01*	**·19**	**·23**	**·22**	**·14**	**·02**	*·10*	*·15*	*·09*	*·07*	*·01*	**·01**	*·05*	1·08
Period, .	**·03**	**·02**	**·08**	**·11**	**·19**	**·21**	**·16**	**·10**	*·01*	*·04*	*·03*	*·01*	**·01**	*·02*	*·04*	*·07*	*·08*	*·09*	*·08*	*·08*	*·09*	*·11*	*·07*	*·03*	1·76
Miles pr. hour	**0·2**	**0·1**	**0·6**	**0·7**	**1·3**	**1·4**	**1·0**	**0·7**	*0·1*	*0·3*	*0·2*	*0·1*	**0·1**	*0·1*	*0·3*	*0·5*	*0·6*	*0·7*	*0·6*	*0·6*	*0·7*	*0·8*	*0·5*	*0·2*	12·3

Note.—The heavy figures indicate above the average and the italic figures below the average.

TABLE VIII.—Showing the Hourly Departure of Barometric Pressure from the Mean of the Day at Cape Pembroke, Falkland Islands, for the years 1903 and 1904.

Thousandths of an Inch.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
A.M.													
1	2	4	6	2	4	3	8	2	10	14	10	3	4
2	1	0	6	7	6	2	5	4	5	12	4	3	1
3	3	0	5	9	7	3	3	10	2	11	1	4	1
4	8	3	8	7	8	7	4	11	2	11	2	4	1
5	12	6	10	3	7	6	3	10	4	9	2	1	0
6	14	14	12	3	6	3	4	6	4	12	1	3	2
7	12	18	15	1	2	1	2	2	0	11	1	3	4
8	8	16	14	1	1	5	0	4	3	8	4	1	4
9	2	14	9	2	3	10	3	6	2	1	3	4	3
10	0	10	4	1	4	15	4	7	0	3	12	4	2
11	2	2	0	1	2	11	3	5	4	11	15	3	1
Noon	5	4	6	3	0	4	4	2	3	13	16	4	5
1	6	10	14	7	2	1	12	5	16	20	12	7	10
2	9	14	19	7	3	3	16	10	20	23	12	7	13
3	14	18	22	4	1	7	14	8	18	22	10	7	12
4	16	19	22	1	4	3	10	2	16	21	10	5	10
5	18	14	17	5	6	2	6	3	9	18	5	4	7
6	10	14	11	3	3	2	2	6	0	7	0	1	2
7	7	9	4	3	3	1	3	3	3	1	6	2	2
8	0	4	1	3	7	3	6	9	12	3	12	7	5
9	4	0	1	3	4	1	3	6	14	11	18	11	7
10	3	4	3	3	2	1	10	3	14	14	21	14	8
11	3	5	4	3	2	1	10	2	14	15	20	10	7
Mdt.	4	6	6	0	2	1	10	0	12	15	15	8	6

NOTE.—The heavy type indicates above the average and the italic type below the average.

TABLE IX.—Showing the Departure from the Annual Mean of the Hourly Values of Barometric Pressure during the drift of the *Belgica*, and at the South Orkneys, South Georgia, Orange Bay, and the Falkland Islands.

Thousandths of an Inch.

	Belgica.	S. Georgia.	S. Orkneys.	Orange Bay.	Falkland Is.
A.M.					
1	2	4	2	1	4
2	1	1	5	0	1
3	1	2	6	3	1
4	1	4	10	5	1
5	1	3	11	3	0
6	1	2	10	1	2
7	2	4	9	0	4
8	1	7	4	0	4
9	0	11	5	3	3
10	1	10	2	4	2
11	0	6	3	3	1
Noon	1	0	2	3	3
P.M.					
1	2	3	1	2	10
2	2	9	1	2	13
3	3	12	2	7	12
4	2	12	1	3	10
5	2	10	6	0	7
6	2	6	9	3	3
7	2	1	11	5	2
8	0	4	13	9	5
9	2	8	12	8	7
10	3	5	8	7	8
11	4	5	5	6	7
Mdt.	3	5	2	6	6

NOTE.—The heavy type indicates an excess and the italic a defect.

It is interesting to note that the curves for the South Orkneys and Orange Bay closely resemble each other, while those for South Georgia and the Falkland Islands also show many points in common, although differing markedly from the first pair. As regards the South Orkneys and Orange Bay, they may both be regarded as on the edge of a continent, for, as already stated, during nearly the whole time covered by the observations at the Orkneys the Austral seas were frozen over. In South Georgia and the Falklands the situation is essentially oceanic; hence are found marked differences in the diurnal range of pressure. The characteristic features of the daily period of pressure at the South Orkneys and Orange Bay are a long-drawn-out minimum and a pronounced evening maximum at both places. At Orange Bay there is an indication of the morning maximum at about 7 and 8 A.M., and it is an open question whether the curve for this station is not more closely allied to that of South Georgia and the Falklands than to that of the South Orkneys. At the South Orkneys the morning minimum is relatively deep compared to the other three places. South Georgia and the Falklands possess a diurnal period of pressure essentially the same, the only pronounced difference being in the morning maximum, which is much smaller at the Falklands than at South Georgia. It will further be observed that the morning maximum and afternoon minimum occur about one and a half hours earlier at the Falklands than at South Georgia.

In connection with the phases of the diurnal range of pressure in this region, much interest will attach to the publication of the results of the Swedish and French Antarctic Expeditions, as well as to the observations made for some years by the Argentine naval officers at New Year's Island, in the proximity of Cape Horn, and those taken under the direction of the Argentine Meteorological Office.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lecture.

Sir Harry H. Johnston, G.C.M.G., K.C.B., closed the Lecture Session in Edinburgh on March 27th, when he delivered an Address on "Liberia," Professor James Geikie, D.C.L., LL.D., President of the Society, presiding. On the motion of Sir James Russell, LL.D., a hearty vote of thanks was awarded the Lecturer.

Meeting of Council.

The following resolution was adopted by the Council of the Royal Scottish Geographical Society, and submitted to the Secretary of State for India in Council:—

In view of the great regret felt in geographical circles throughout the world that the proposed expedition down the Brahmaputra to Assam did not take place

at the close of the Tibet Mission, 1903-4, the Council of the Royal Scottish Geographical Society trust that the Indian Government will now see their way to carry out this exploration, which is of extreme interest and importance on the following grounds :—

1. By it would be finally settled the question of the connection of the Tsangpo of Tibet with the Dibong (Brahmaputra) of Assam.

2. The known difference of levels render it certain that the river must descend from Tibet to the plains of India by great waterfalls, exceeding all others in height and volume. These falls (which are said by the Tibetans to exist) would be discovered.

3. Much light would be thrown on the geology of the region. In particular we might expect information as to the structure of the country traversed—the relation borne by the vast Himalayan ranges to the elevated plateau against which they abut. It would further be interesting to ascertain whether any strata of Mesozoic and Tertiary age occur.

4. Nothing is at present known of the tribes who inhabit the tract through which this part of the river passes. It lies between the south-east boundary of Tibet and the country of the Abors, which borders on British territory.

5. Valuable collections of the fauna and flora would probably be obtained in the region in question, which must consist mainly of very deep valleys hemmed in by lofty mountain ranges, and almost entirely closed to outside influences.

6. It is possible that a good route might be discovered leading from Assam into Tibet by way of the valley of the great river. Such a route would have much importance in promoting British trade with Tibet.

Signed by James Geikie, D.C.L., LL.D., F.R.S.S.L. and E., President of the Royal Scottish Geographical Society.

GEOGRAPHICAL NOTES.

Europe.

The Eruption of Vesuvius.—Early in April, Vesuvius, which had displayed considerable activity for some time previously, was the scene of a violent eruption which it is believed will be found to rank high among the great eruptions of that volcano. As usual in such cases, the human aspect of the calamity has meantime obscured the scientific, but at a later date we hope to publish here a summary account of the phenomena of the eruption. It would appear meantime that the maximum of activity was reached about the 7th or 8th of April, and as in previous cases the ejectamenta have taken the threefold form of lava streams, showers of stones, and dense clouds of "ashes," including grey-black dust and sand, all of which have played their part in the destruction of towns and villages, as well as of vegetation. Fortunately Professor Matucci, the director of the Vesuvius Observatory, has been able to remain at his post in spite of the danger, so that full scientific data should be available later. The towns of Ottajano, Bosco-Trecase, and San Giuseppe have, it is stated, been completely destroyed, while Portici, Torre del Greco, and Torre Annunziata have suffered severely.

Africa.

The Benue-Logone Route to Lake Chad.—It would appear that this route is now being used as a means of conveying supplies to Lake Chad. According to *Petermann's Mitteilungen* (ii. 1906, p. 48), the first practical utilisation of the route occurred in the middle of 1905, and now arrangements have been made with the English Niger Company to convey stores to Lere, the first French post on the Mayo-Kebbi, at a cost of 375 francs per ton. From Lere the stores are to be conveyed to the Tuburi by means of horses, and from the lake shore they will be transported by water.

America.

The Mineral Wealth of Bolivia.—We have recently received an official pamphlet called *Geografía de la Republica de Bolivia,* which among other interesting matter contains a very full account of the mines of the country, many of which still await development.

Bolivia resembles Switzerland in that it is entirely inland, has no outlet whatever to the sea. Like Switzerland also, it has its mountain chains of snow-clad peaks, Sorata and Illimani rearing up their crests to 7696 and 7509 metres respectively. But here the resemblance ceases, for while Switzerland teems with a hardy and adventurous race, which finds its native country all too narrow for its development, and spreads all over the globe, Bolivia, while possessing territories which are a very dream of riches, has a population so scanty that it cannot follow up its advantages. This is the burden of the whole volume, the lack of men and of enterprise.

As is well known, the Republic consists of the eastern and western ranges of the Andes, enclosing a great central plateau, the average height of which is 3800 metres, and which contains nearly all the region that is rich in mines. To the east of the oriental cordilleras, there stretch down towards Brazil heavily wooded slopes and smiling valleys; and here the wealth of the country consists in forests and arable land.

The national industries have developed very imperfectly, owing to the scarcity of labour and the want of capital. The inland situation of the Republic, separated as it is from the Pacific by the Andes and the desert of Atacama, and bounded by enormous forests to the east, has up to the present time excluded it from the advantages of over-sea commerce. So far, the great waterways have not been utilised to carry goods to or from the coast, as they should. There are practically no roads to the coast, as we understand the term. The only railways are those from Antofagasta to Oruro (924 kilometres), and from Huaqui to La Paz (87 kilometres), besides a branch line to Huanchaco. The only other means of transport are droves of mules and llamas, which open up paths by their hoofs.

The greatest asset with which Bolivia enters the world's markets is the abundance of her minerals. Mining is the chief industry. The mountains enclose veins of all the most valuable minerals, the chief being gold, silver, tin, and bismuth. There are three auriferous regions.

The first extends from the basin of the Inambary on the west, passes through the departments of La Paz, Cochabamba, and Santa Cruz, and terminates in the region of the Upper Paraguay. It includes the famous alluvial workings of San Juan del Oro, Suches, Tipuani, etc., and the mines of Araca, Yani, Cavari, and many others. Some of these are well known for their extraordinary wealth. The second region is found in the departments of Potosí, Tarija, and Chuquisaca, extending also towards Santa Cruz. To this region belong the deposits and placers of Susques, Huahuarcosia, Choqueuta, Chuquichuqui, and many other famous workings. The third region, perhaps the richest of all, is not yet worked. It extends to the north-west of the Republic, bordering on Carabaya (Peru), and the sources of the Madre de Dios, Acre, and Purus.

The silver-producing regions are chiefly in the departments of Oruro and Potosí, the latter being the richest and most abundant in mines, including, as it does, Huancheca, Aullagas, Colquechaca, and many other famous mines.

It is stated that in all the Republic there are more than 10,000 silver mines abandoned. This has been owing to want of capital and other inconveniences, never to deficiency of the metal. Among the mines of Potosí, Pulucayo stands out pre-eminent. It is reputed to be the first in South America, and only comes second to Broken Hill, in Australia, which is the largest producer in the world.

Tin is mostly found in La Paz in the north, Oruro in the centre, Chorolque in the south, and Potosí in the east. Of bismuth it is said that Bolivia is the first producer in the world; and of copper, that of all the metallic riches which are to be found in Bolivia, none transcends it either in abundance or in quality.

Earthquake at San Francisco.—On the morning of April 18, the district of San Francisco was visited by two severe shocks of earthquake, which laid a considerable part of the city in ruins. The work of destruction begun by the earthquake was completed by fires which broke out immediately afterwards, and practically destroyed the city.

Polar.

Drift Cask Experiment in Arctic Seas.—In 1897 Mr. H. G. Bryant, President of the Geographical Society of Philadelphia, suggested a scheme for investigating Arctic currents by means of drift casks. With the assistance of Admiral Melville the scheme was carried out, and during the years 1899, 1900, and 1901 thirty-five casks were set adrift by whalers and others. Not till October 1905 was anything heard of any of the casks, but in that month messages were received in regard to two of them. In the *Bulletin of the Geographical Society of Philadelphia* for January details are given as to these two casks. The one, liberated on August 21, 1901, about 85 miles north-west of Wrangell Island (lat. 72° 18′ N., long. 175° 10′ W.), was picked up on August 17, 1902, near the mouth of Kolyuchin Bay, on the Siberian Coast, after a journey of only 380 miles. The other, placed on the floe ice, west-north-west of

Point Barrow, Alaska, in lat. 71° 53′ N. and long. 164° 50′ W., on September 13, 1899, was found one mile east of Cape Randa Nupr, on the northern coast of Iceland, on June 7, 1905, in lat. 66° 31′ N. and long. 16° 28′ W., a distance of some 2500 miles having thus been traversed if the route taken was a direct one. It is probable that this cask was transported by the current which, starting in the Arctic Sea north of Behring Strait, moves in a north-westerly direction along the Siberian coast, passing to the north of the New Siberian Islands, and aided by the warm discharges from the Siberian rivers sweeps around and across the polar area north of Franz Joseph Land, emptying itself into the sea between Greenland and Spitzbergen, and thus eventually reaching the North Atlantic. As the casks were originally set adrift with the hope of confirming the belief in the existence of this drift, the journey of this cask is of great interest. For parts of its course it doubtless followed the lines of drift of the *Jeannette* and the *Fram*.

The Mylius-Erichsen Expedition.—In *Petermann's Mitteilungen* (ii. p. 45) a very full account is given of the plans of this expedition (cf. this *Magazine*, xxi. p. 663) from which we extract the following account, supplementary to previous notes.

The expedition is to leave Copenhagen at the end of June or the beginning of July in a specially constructed vessel for Tromsö. From Tromsö the course will be directed to Bear Island and Spitzbergen, and then for the pack-ice of East Greenland in the vicinity of the 76th or 77th parallel. An attempt will be made to reach as far north as possible, and the experience of the *Belgica* shows that it is within the bounds of possibility that lat. 80° N. may be reached. At the most northerly point attained, whatever this may be, a meteorological station will be set up, and a party of four left in it. So long as the ice permits, the ship will continue to sound and explore in the vicinity, and then will turn southwards again, to find winter quarters either at Cape Bismarck or, if necessary, further south at Shannon Island. After the ship has gone into winter-quarters the rest of the autumn will be spent in sledge-journeys and laying down depôts between the station and the ship, at the mouths of fiords, and so forth. A meteorological station will also be set up at the wintering-place of the ship. At the beginning of February 1907 a party will sledge from the winter-quarters to the northern station. Some of the members of this party will be assigned scientific work at the station or in its vicinity, but one small party will make the attempt to reach Peary's easternmost point on Wyckoff Island, *via* Independence Bay (cf. Map of Peary's Discoveries, vol. xix. p. 617), and will attempt, if possible, to reach even further north. Another northern party, under the leader, will go through the Peary Channel, in order to explore Nares Land and De Long Fiord, while yet a third group will remain in Independence Bay to act as a supporting party to the other two. All three parties on their return in the middle of April will take part in the investigation of the unknown coastline from Academy Land southwards. Towards the close of May the northern station will be abandoned, and all the parties will return to the ship. Meanwhile

those left at the winter quarters will have completed their investigations in the vicinity of the ship.

When the ice breaks up in June the ship will be directed southwards in order to investigate the fiords, and a new meteorological station will be set up in Franz Joseph Fiord, while the ship will seek winter quarters at the mouth of the fiord or in Mackenzie Bay. From this spot investigations will be carried on so long as the light and conditions of the ice permit. At the end of March the leader with a party will start from the station in Franz Joseph Fiord to investigate the inland ice, to which it is hoped to gain access by means of a glacier valley. It is possible, if all the conditions are favourable, that an attempt may be made by a small party to cross the ice to the west coast of Greenland.

In the summer of 1908 the ship will explore the coast so far as Scoresby Sound within the pack-ice, and then will break through the pack, and journey outside of it to the Mission Station of Angmagssalik, whence the return will be made to Copenhagen in September 1908.

General.

The Royal Geographical Society's Awards.—The following announcements are made in regard to the awards for 1906. The Founder's Medal is awarded to M. Alfred Grandidier for the results of his many years' work on the Island of Madagascar. The Patron's Medal goes to Dr. Robert Bell, F.R.S., Acting-Director of the Canadian Survey, for the large amount of work he has done in connection with the mapping of previously unknown areas in Canada. The Victoria Research Medal has been awarded to Professor W. M. Ramsay, D.C.L., LL.D., in recognition of his work in connection with Ancient Geography, especially in Asia Minor.

The Murchison Award has been given to Major H. R. Davis for his explorations in the Shan States, Kachin Hills, Yun-nan, Siam, and Sechuan. The Gill Memorial has been awarded to Major A. St. Hill Gibbons for the important exploring and survey work which he has done in Barotseland on his two expeditions in 1895-96 and in 1898-1900. The Cuthbert Peck Fund has been awarded to Major H. H. Austin, C.M.G., D.S.O., R.E., for his exploration in the Lake Rudolf region, the Sobat region, and his hazardous expedition from Omdurman to Mombasa *viâ* Lake Rudolf in 1900 and 1901. The Back Bequest goes to Major R. G. T. Bright, C.M.G., for his 8½ years' exploring work in the Sudan, Uganda, and East Africa.

Royal Geographical Society of Australasia, Queensland.—This Society intends to celebrate the twenty-first anniversary of its foundation in the last week of June next, and we have received various notices connected with this event. The Society has recently received a valuable donation in the shape of the whole of the scientific instruments used by the Gregorys in their explorations in North-West Australia, and it is proposed that these shall be exhibited during the anniversary celebrations.

Commercial Geography.

The Simplon Problem.—We have on various occasions alluded here to the questions which have been raised in France and Switzerland as the result of the approaching opening of the Simplon tunnel, and the numerous suggestions which have been made as to new lines of rail to connect with the Simplon route, or compete with it as a means of access to Italy. We have recently received another pamphlet on the subject by Professor Jean Brunhes, the paper being an extract from the *Revue Économique Internationale* for February 1906. The object of the paper is to press the claims of the Frasne-Vallorbes route as against the Faucille project (cf. xx. p. 87), but attention should be specially drawn to the clear series of sketch maps and diagrams, which enable one to grasp the main features of the questions involved at a glance.

An Alaska-Siberia Railway Project.—It is stated that a Russian Government Commission is considering a project to construct an Alaska-Siberia railway with a tunnel beneath the Behring Strait. The cost of the enterprise, which is said to be promoted by an Americau syndicate, is estimated at 47 millions sterling. The proposal is that the Asiatic portion of the line should connect at Kansk with the Trans-Siberian Railway, and that the American portion should ultimately be linked with the Canadian Pacific line.

The Mineral Matter of the Sea.—Readers of the *Magazine* who were interested in Professor Salisbury's article on this subject published last year (xxi. p. 132) should note a further article on the same subject by Professor Salisbury in *The Journal of Geology* (xiii. p. 469), in which the author puts forward some speculations on the bearing of his results upon certain geological problems, especially the changes in level of land and sea which have occurred in geological time.

NEW BOOKS.

EUROPE.

Baku: an Eventful History. By J. D. Henry. London: Arch. Constable and Co. *Price* 12*s.* 6*d. net.*

Baku is the centre of the Russian oil industry, and is the greatest oil city of the world. It is situated on the Caspian Sea sloping down from the Caucasus Mountains. In any country it might be expected that the population that would centre in such a town would contain an undue proportion of the unruly element. But in Baku everything seems to combine to increase this. The town itself, and the surrounding country, contain a conglomeration of nationalities which is probably unique. No fewer than forty-four are registered, and the chief nationalities number thirteen. In addition to this, in the surrounding district racial and religious bitterness is probably more intense than anywhere else in the world. The feuds between Tartars and Armenians were matter of history long before oil was discovered. But the result in modern times is that when an outbreak such

as that of last September does occur, the battle of savagery and massacre is fought out among blazing oil-fields which adds fourfold to its horror.

The first part of the book contains a description of the rise of the town, and of the growth of the industry, and necessarily deals largely with statistics. But even figures can be made impressive, and there is a great deal in the narrative of non-technical matter which is of interest to the general reader. The second part of the book, which relates to the massacres of February and September of last year, probably gives one of the most reliable accounts of what took place during these fearful times. It is almost impossible to imagine that such events could have happened in these days in a country under the government of one of the great powers of Europe. In addition to the loss of life, the enormous destruction of property has necessarily crippled and arrested the progress of the oil industry. As Mr. Henry says, the chief thing now wanted to ensure the return of prosperity to Baku is a lasting peace, because, until that can be guaranteed, it is impossible to expect the assistance of foreign capital in the development of the mineral and industrial resources of the Caucasus.

The book is both well written and well illustrated.

ASIA.

Java: Facts and Fancies. By Augusta de Wit. Pp. ii + 332. With 160 Illustrations. London: Chapman and Hall, 1905.

The title of this book is appropriate. The authoress paid a somewhat lengthened visit to Java, living apparently with Dutch residents in the island, at Batavia, Buitenzorg, and in the neighbourhood of the Tjerimai mountain to the south of Cheribon. The journey to the last of these places of sojourn was made by railway across the upland plain of the Preanger, and thereafter by pony cart. Further east than Cheribon the authoress seems not to have gone. Her experiences in the island, therefore, were limited to its western or Sundanese end.

The luxuriant and varied vegetation, the beauty of the soft, sunlit atmosphere, and the simplicity and insouciance of native life fascinated the authoress, so that into and around the facts which attracted her notice, she has woven a superabundance of fancies. The book, in fact, is not a serious contribution to the prosaic knowledge of Java. It is rather the record of the impressions and reflections of a woman's mind, sensitive to the glamour of nature in the gorgeous East, and sympathetic with the placid, dreamy, almost pathetic character and tone of a people which knows not the strain of industrial competition, and is content to live from day to day on whatever the gods provide of good or ill. The manners and customs of the dominant Dutch are more or less touched on. But the chief interest of the book is to be found in the admixture of fact and fancy concerning the varied aspects of nature, the traditions and ceremonials of village life, and the habits, pursuits, and recreations of the natives. The illustrations are very numerous, and are as valuable as the letterpress which they illuminate. They are indeed more extensive, many of them representing objects and scenes not mentioned in the letterpress.

Philippine Life in Town and Country. By James A. le Roy. New York and London: G. P. Putnam's Sons, 1905.

This is a very interesting volume, but its name is likely to be misleading to English readers. It is not one of the Town and Country Series which is now being published by George Newnes, Ltd.; it is an American publication "concerned alone with the general facts which lie at the basis of Philippine society

and the general movements which make up that society to-day." Incidentally we have sketches of Philippine life in some of its aspects, but the main object of the book is much more serious. "Its purpose is to set forth the Filipinos as they are, avoiding on the one hand psychological speculation under the guise of analysis of their characteristics, and on the other hand political propaganda in behalf of any theoretical plan for their future government, or in behalf of the compromise plan under which they are at present being ruled." As is well known, the Philippine Islands passed into the possession of the United States of America at the end of the Spanish war some seven years ago, so they are now in what may be called a transition state; they are out of the hands of their former conquerors, the Spaniards, and are not yet quite reconciled or accustomed to their new masters, the Americans. This work is a thoughtful and instructive discussion of the *status quo* in the Archipelago. The writer is anxious to do justice to the Spaniards and to dissipate a notion, common, it would seem, in America, that Spain had done little or nothing for its Eastern colony; and he discusses temperately and acutely the difficulties and problems with which the United States are confronted in the commencement of their colonial régime. The Filipinos are undoubtedly of Malay origin, but three centuries of Spanish domination have so affected them that recent British experience in dealing with other Malay populations is of practically no value to our American cousins. Mr. Le Roy indicates the right spirit in which the task should be carried on, *i.e.* one of patience and perseverance, with a kindly sympathy for the conquered race, with no preconceived theories and prejudices, and with a single eye to the social, political, and moral development of the people. Previous to the arrival of the Americans, education in the islands was in the hands of the Spanish friars, with results which, as described by Mr. Le Roy, were both contemptible and ludicrous. But "American teachers were summoned to the Philippines by the boatload at first"; it was decided to substitute English for Spanish wherever possible in the schools, to lay the foundations of what we in Scotland know as primary and secondary education, to start normal schools for teachers, and to prepare the ground for what will be ere long a university at Manilla. An ambitious programme; but we learn that in 1905, out of an estimated school population of 600,000, no less than 510,000 were enrolled in one school or another—a result on which both Filipinos and Americans are most heartily to be congratulated. The Americans are also taking seriously in hand the improvement of the roads and communications and the development of the various material resources of the islands, and there is no reason why we should not anticipate for the Archipelago a prosperous and successful future under American rule.

The Re-shaping of the Far East. By A. L. Putnam Weale, author of "Manchu and Muscovite." London: Macmillan and Co., Limited. New York: The Macmillan Company, 1905.

This is one of the best of the many books which are the inevitable result of the late war between Russia and Japan. The object of the work is avowedly political, viz. to "awaken the British Government to a sense of its responsibilities and to the necessity for immediate action," unless it is prepared to see "another war in a very few years." The great war, however, was not concluded when this work was published, and a good deal has occurred since the publication which might possibly cause the author to modify some of his views. He has evidently travelled much in China, Korea, and Japan, and has kept his eyes wide open to everything that was going on around him. His descriptions of German, French, Belgian, and Russian

intrigue are amusing as well as instructive and acute. The general result of the writer's observation is to confirm what has been repeatedly pointed out by others, viz. that China is at last awakening from her long sleep and becoming aware of the fact that she can no longer refuse or avoid having extensive political and commercial relations with the other Powers; that she is beginning to arm herself, and has already a trained force of eighty thousand men, and in course of time she *may* have an efficient force of anything between two and three millions of excellent soldiers; and that she is still hampered by being "unable to shake off any of the outward and visible forms of the Chinese system." The question is asked, who is to undertake the training and education of the half-aroused giant? and the answer, according to Mr. Weale, is, "England and no other Power; for England has in past years done all the pioneer work, not only in China, but in Japan, and still occupies in a manner which admits of no contradiction the premier place in the Far East." We cordially recommend this thoughtful and instructive work to our readers, and we have to add that it is equipped with an excellent map, and is illustrated by many good photographs.

Benares, the Sacred City: Sketches of Hindu Life and Religion. By E. B. Havell, Principal of the Government School of Art, Calcutta. London: Blackie and Son, 1905. *Price* 12*s.* 6*d. net.*

This work is, the author states, an attempt to give an intelligible outline of Hindu ideas and religious practices, and is especially a presentation of the imaginative and artistic side of Indian religions which can be observed at few places so well as in the sacred city of Benares and its neighbourhood—the birthplace of Buddhism and of one of the principal sects of Hinduism. The illustrations, which are numerous and good, have been for the most part specially prepared to elucidate the text, and include some of the remarkable discoveries made last year at Sarnath, near Benares, by the Archæological Department, which have given a wonderful actuality to the description of Benares given by Hiuen Thsang, a Chinese pilgrim who visited the city about the eighth century A.D. The first definite historical account of Benares and its neighbourhood was given by another Chinese pilgrim, Fa Hian, who visited India about the beginning of the fifth century A.D. for the purpose of getting exact information about the teaching of Buddha.

In the Land of the Gods: Some Stories of Japan. By Alice Mabel Bacon. London: Archibald Constable and Co., 1905.

We have here a singularly fresh and charming collection of Japanese stories, whose geographical interest is the light they cast upon the habits and customs of the people of the islands.

Life in West China, described by two Residents in the Province of Sz-chwan. By Robert J. Davidson and Isaac Mason. London: Headley Brothers, 1905.

This book is stated in the preface to be an attempt to give a historical sketch of the Friends' Mission in China. Thus, although there are chapters on the geography and so forth of the Province concerned, these are subservient to the main purpose of the book—a purpose outside our scope. These chapters, however, give an interesting account of life in China.

AFRICA.

Life in Morocco, and Glimpses Beyond. By Budgett Meakin. London: Chatto and Windus, 1906. *Price* 12*s.* 6*d.*

This work appears very opportunely, as no country has of late arrested such general attention as Morocco, a congress of all the Powers having sat for months at Algeciras endeavouring to settle its future. Mr. Meakin is entitled to speak on the subject, for, besides frequent visits to Morocco, he has made it a special study during the past eighteen years, and has already written three books on the history, customs, and land of the Moors. His wife also has assisted him by contributing chapters to the present work on "Social Visits," "Dining Out," and "Shopping" in Morocco. Both write in an easy, attractive manner, which, eked out with good illustrations from photographs, combine to make a very readable book. Mr. Meakin considers that "nothing he has seen elsewhere excels Morocco in point of life and colour save Bokhara, and only in certain parts of India or in China is it rivalled. . . . The bazaars of Damascus even, and Constantinople, have given way to plate-glass, and nothing remains in the nearer East to rival Morocco." He asks, "Of what European, or even Oriental, land could descriptions of life and manners written in the sixteenth century apply as fully in the twentieth as do those of Morocco by Leo Africanus?" While the Moors have an unquenchable spirit of independence, which differentiates them from the Egyptians or Hindoos, they live in a state of anarchy, poverty, and oppression. "In Morocco each official preys upon the one below him, and on all others within his reach, till the poor oppressed and helpless villager lives in terror of them all, not daring to display signs of prosperity for fear of tempting plunder."

The author adds that there is an absolute lack of morals among the Moors, and that it is their licentiousness which has made them "sink into an indolent, procrastinating race, capable of little in the way of progress till a radical change takes place in their morals." At the same time they are, "as a nation, by no means treacherous or cruel; on the contrary, the average Moor is genial and hospitable, does not forget a kindness, and is a man whom one can respect." The Reefian Berbers are among the finest men in Morocco, warlike and fierce, but with many excellent qualities. The Atlas mountains have always been their home and refuge, and they are separated from the Arabs by a totally distinct unwritten language.

Applying the Moorish proverb, "Teach not thy daughter letters; let her not live on the roof," the Moors hold women in absolute subjection. Even marriage is ended by a husband simply saying to his wife, "I divorce thee!" The welfare of women's souls is supposed to be assured by marriage with a Mussulman; and while Moorish women's religion is the grossest superstition, few know even how to pray. "No race can ever rise above the level of its weaker sex, and till Morocco learns this lesson it will never rise."

The court of the Sultan of Morocco is not permanently settled anywhere, wintering successively at one of the three capitals—Fez, Marrákesh, or Mequinez. The author describes the present Sultan—Mulai Abd el Azin—as "a mild and well-intentioned youth," aged twenty-six, and he says the Sultan will welcome the introduction of railways, which are likely to be the "first roads" in Morocco. With regard to trade in Morocco, he remarks that twenty-five years ago "Germany had not even a commercial interest" there. "Now she stands next to Britain," whose trade is reduced to one-half of the whole. The imports from, and exports to, the United Kingdom for 1903-4 amounted together to £1,438,805.

GENERAL.

Nature Through Microscope and Camera. By Richard Kerr, F.G.S., F.R.A.S., with Sixty-five Photo-micrographs by Arthur G. Smith. London: The Religious Tract Society, 1905.

This beautifully illustrated volume has no very direct bearing upon the study of geography, but the geographer will be interested in the chapter on "Foramenifera and Radiolaria," and the account of the mosquito has also some geographical significance.

Leitfaden der Handelsgeographie. Von Dr. Max Eckert. Leipzig: G. J. Göschen, 1905. Pp. 248.

In this smaller form the contents of the *Grundriss der Handelsgeographie*, noticed in vol. xxi. p. 284, are abridged and adapted for school use. The arrangement is in some parts rather different, the statistics have been curtailed, and the commerce of Germany occupies a prominent position throughout the book.

ANNUALS.

The Science Year-book, with Astronomical, Physical, and Chemical Tables, Summaries of Progress in Science, Directory, and Diary for 1906. (Second year of issue.) Edited by Major B. F. S. Baden-Powell. London: King, Sell, and Olden. *Price* 5*s.*

The present issue of this annual shows a number of alterations as compared with the previous one, and in its present form should prove useful to men of science. Among the new features of great capacity for usefulness is the list of the books of the year, but we have noticed in this several instances of careless editing. Further, in some cases the books are given as references at the ends of the articles on the progress of the different sciences during the year, so that there is needless repetition, very undesirable in a book of reference. In the "Books of the Year" the only book on Geography we notice is the *Voyage of the Discovery*, placed under "Miscellaneous," and sandwiched between *Glimpses of the Ages* and *The Mental Traits of Sex*. Oddly enough, there is also a heading for "Psychology," so we presume there must be some subtle reason why the last-named is not placed under it.

The inclusion in the volume of what is called a "Biographical Directory," like the Bibliography, obviously affords scope for criticism, for, as in the latter case, it is difficult to see the basis of inclusion or exclusion. Thus, of two Edinburgh geologists of equal eminence, one is included and the other omitted. The varying lengths of the notices also afford many opportunities to the scoffer. We have been entertained to observe that one gentleman gives, among his many claims to scientific fame, the fact that he has written to the *Times*!

On the whole, we feel that, good as is in many respects the scheme upon which the volume is constructed, it requires more thorough editing than it has received, or, perhaps, it would be more just to say, that the scheme is rather more elaborate than the available means of carrying it out. But it has many valuable features.

Daily Mail Year-book: A Handbook to all the Questions of the Day for 1906. (Sixth year of issue.) Edited by Percy L. Parker. London: The Amalgamated Press. *Price* 1*s.* 6*d.*

For its extremely moderate price, this annual contains a large amount of information, but this is set forth with a want of soberness and restraint and with

a striving after effect which must render the book distasteful to many. Those who are not sensitive on such points will doubtless find it useful.

Willing's Press Guide and Advertisers' Directory and Handbook. Thirty-third year. London: James Willing, Junr., 1906. *Price* 1*s.*

This very useful annual not only contains a list of the newspapers and periodicals published in the country, but also lists of the chief Colonial, Foreign, and American papers, as well as a large amount of other information, and is of great value as a book of reference.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

The Making of Modern Egypt. By Sir Auckland Colvin, K.C.S.I., K.C.M.G., etc., late Lieutenant-Governor of the North-West Provinces and Oudh; formerly Comptroller-General of Egypt and Financial Adviser to the Khedive. With Portraits and a Map. Demy 8vo. Cloth, gilt top. Pp. xvi + 428. *Price* 18*s. net.* London: Seeley and Co., 1906.

Mediæval Rhodesia. By David Randall-Maciver, M.A., F.R.G.S. Illustrated. Demy 4to. Pp. xvi + 106. *Price* 20*s. net.* London: Macmillan and Co., 1906.

Observations of a Naturalist in the Pacific between 1896 *and* 1899. By H. B. Guppy, M.B., F.R.S.E. Volume II., Plant-Dispersal. With Illustrations and Maps. Demy 8vo. Pp. xxviii + 627. *Price* 21*s. net.* London: Macmillan and Co., 1906.

Our Waterways: A History of Inland Navigation considered as a Branch of Water Conservancy. By Urquhart A. Forbes and W. H. R. Ashford. Demy 8vo. Pp. xvi + 336. *Price* 12*s. net.* London: John Murray, 1906.

Our Planet. "Round the World Geographical Readers." Crown 8vo. Pp. 256. *Price* 1*s.* 6*d.* Edinburgh: T. C. and E. C. Jack, 1906.

The World of To-Day: A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Volume v., South America. Pp. viii + 266. *Price* 8*s. net.* London: The Gresham Publishing Co., 1906.

Deux Années au Setchouen. Par Le Dr. A. F. Legendre. Un vol. in 16. Pp. xvi + 547. *Prix* 5 *francs.* Paris: Plon-Nourrit et Cie., 1906.

By-Paths in the Balkans. By W. V. Herbert. Demy 8vo. Pp. xiii + 269. *Price* 10*s.* 6*d. net.* London: Chapman and Hall, 1906.

Great Britain: Handbook for Travellers. By Karl Baedeker. With 22 Maps and 58 Plans. Sixth Edition. Pp. lxvi + 606. *Price* 10*s.* Leipzig: Karl Baedeker, 1906.

Lehrbuch der Schwedischen Sprache von J. C. Poestion. Cr. 8vo. Pp. viii + 180. *Prix* 2 *marks.* Leipzig: A. Hartleben, 1906.

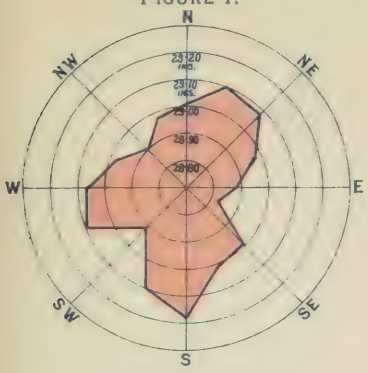
The list of *Reports* received is unavoidably held over from want of space.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THERMAL, BARIC, AND OTHER WINDROSES IN THE WEDDELL SEA SOUTH OF 60° S., DURING THE TWO SUMMER CRUISES OF THE "SCOTIA," IN 1903 AND 1904.

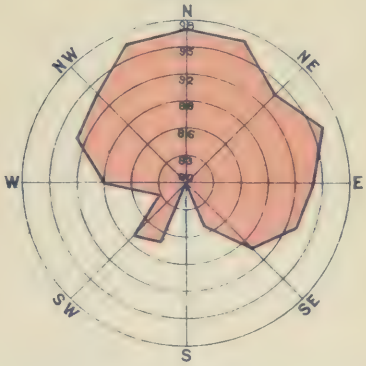
Barometric Pressure.

Figure 1.



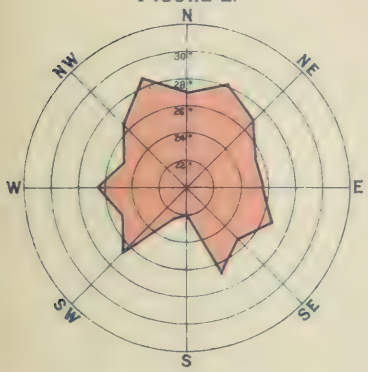
Amount of Cloud.

Figure 5.



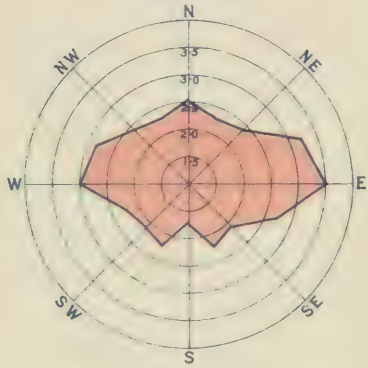
Air Temperature.

Figure 2.



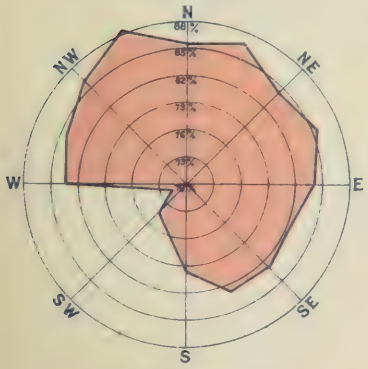
Strength of the Wind. Scale 0-12.

Figure 6.



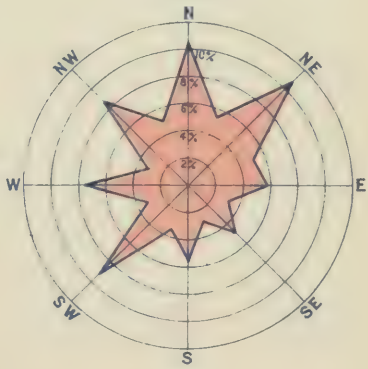
Relative Humidity.

Figure 3.



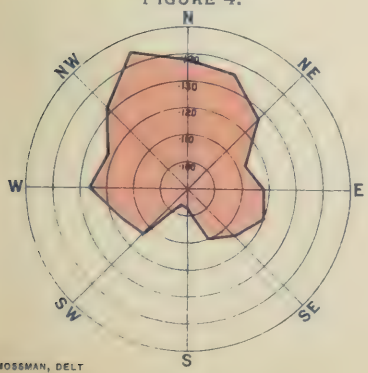
Wind Frequency, Per Cent.

Figure 7.



Vapour Pressure.

Figure 4.



C. MOSSMAN, DELT

A. RITCHIE & SON, EDIN.

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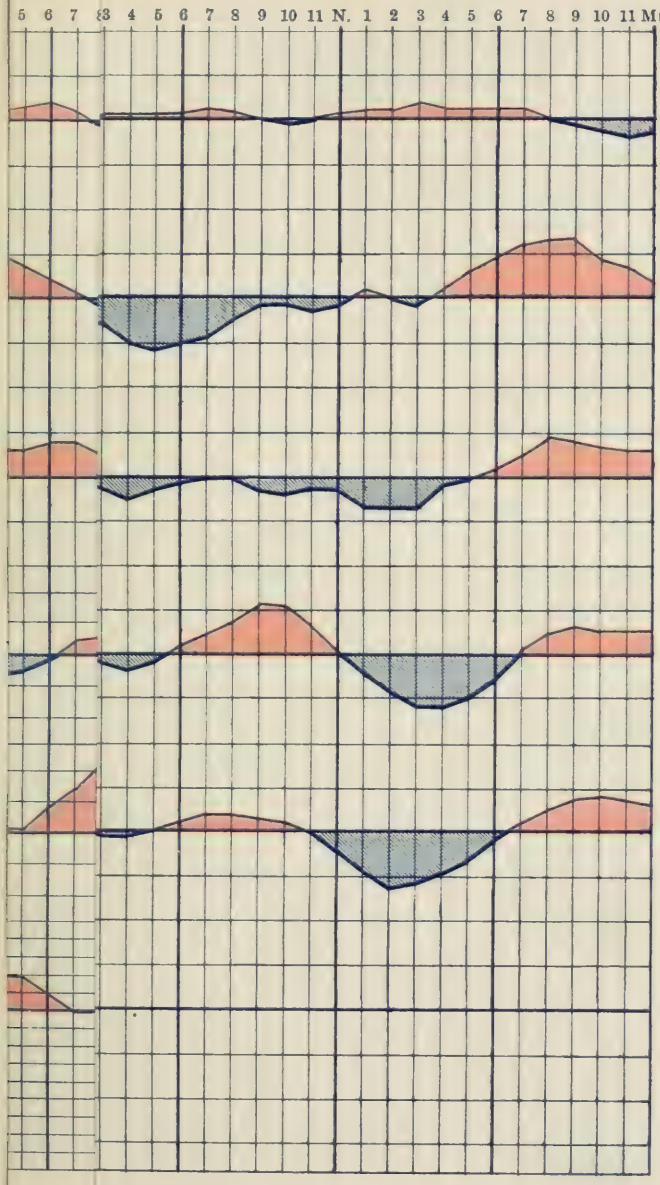
A.

Diurnal Range of Pressure.

Figure 13.



A. RITCHIE & SON, EDIN.ª

Diurnal Range of Pressure, Temperature, &c. in the Weddell Sea, and South Atlantic, and at Scotia Bay, South Orkney Islands

Note.—Red indicates an Excess and the Blue a Defect

Weddell Sea
February 1903
Figure 8

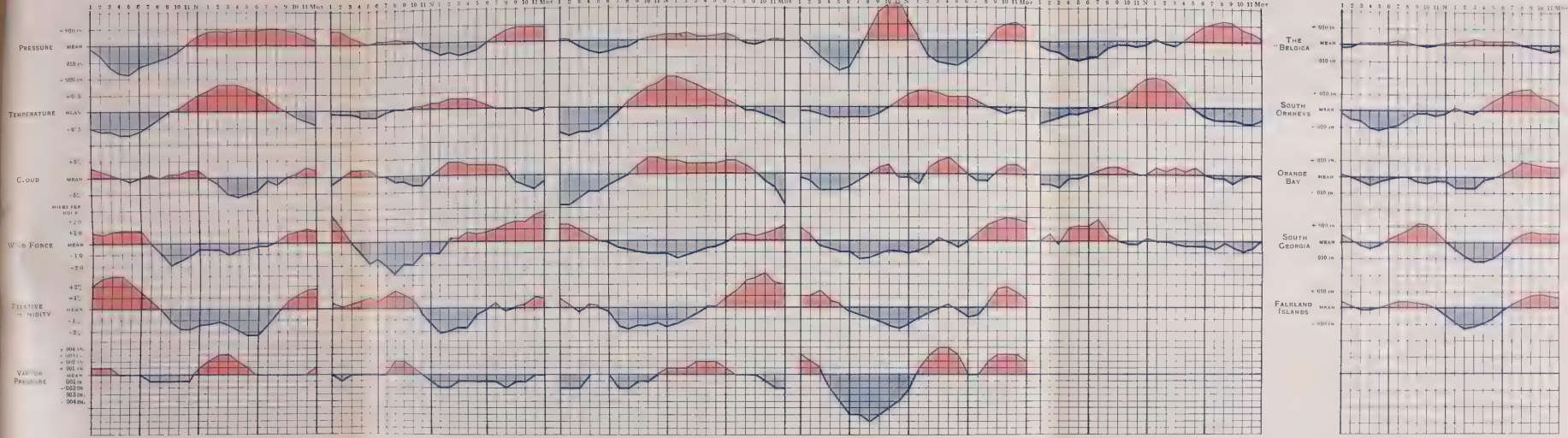
Weddell Sea.
March 1903
Figure 9

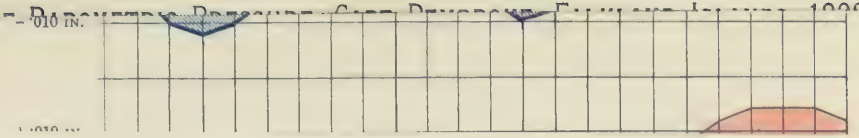
Weddell Sea.
March 1904
Figure 10

South Atlantic.
April 1904
Figure 11

South Orkneys.
April 1903 to January 1904
Figure 12

Diurnal Range of Pressure.
Figure 13


1 2 3 4 5 6 7 8 9 10 11 M 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 M
Pressure
Temperature
Cloud
Wind Force
Relative Humidity
Vapour Pressure
The Belgica
South Orkneys
Orange Bay
South Georgia
Falkland Islands
MEAN

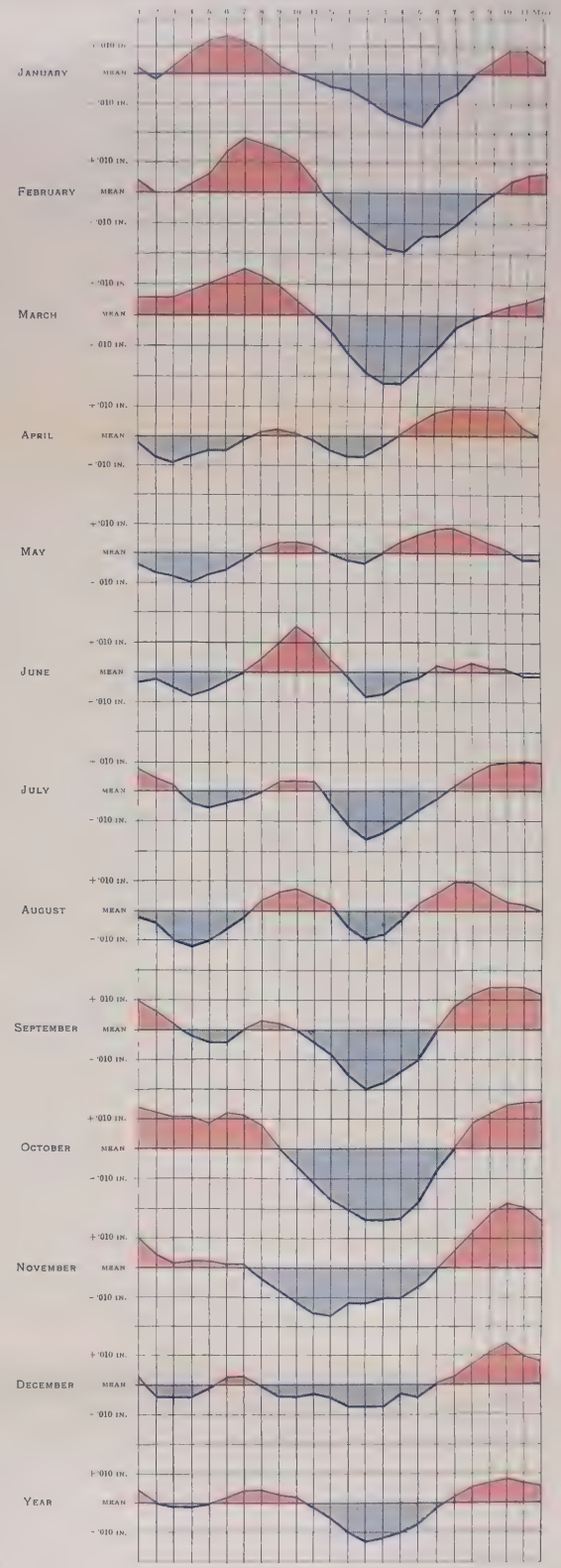

.010 IN.

DIURNAL RANGE OF BAROMETRIC PRESSURE, CAPE PEMBROKE, FALKLAND ISLANDS, 1903 AND 1904.

LAT. 51° 42′ S. LONG. 57° 48′ W.

NOTE.—THE FIGURES IN ROMAN TYPE ARE THE HOUR OF GREENWICH MEAN TIME.

FIGURE 14.



THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE KINGUSSIE DISTRICT: A GEOGRAPHICAL STUDY.

By Marion I. Newbigin, D.Sc. (Lond.).

(With Map and Illustrations.)

Introduction.

Since the rise of what is sometimes called the new geography, many articles have been written on populous towns, districts, or counties, with the object of showing how the development and prosperity of the area chosen has been conditioned by its physical features. The contrary problem, however, of the reason why certain regions have had their development arrested, has attracted less attention, though geographically it is quite as interesting. Certain of these regions of arrested development have acquired a secondary importance as health or pleasure resorts, and it is to one of these districts that the following article is devoted. Before proceeding to the special subject, however, something must be said of health resorts in general.

In the first place, it may be well to emphasise the fact that while it is true that the evolution of a health resort presupposes an advanced state of civilisation, it is to be noted that it presupposes also a local arrest of development. Those who seek rest and recreation in each recurring summer are the inhabitants of regions where the stress of life is greatest, and therefore they naturally seek localities where the struggle for existence, however keen, is of a kind to which they themselves are unaccustomed—is with nature rather than with man. Further, the natural demand for abundant fresh air and sunshine can only be satisfied in regions where land is of but little value, and can be readily obtained. In Britain generally, the lengthy coastline, with its marginal belt of lands largely useless for purposes of cultivation, satisfies to a large extent this need, as witness the abundance of seaside resorts. To a further

extent the demand is satisfied by the stretches of barren upland country, too poor for cultivation, which enable the populations of the towns to renew their strength, summer after summer, by contact with mother earth. The district which has been selected for the subject of this paper is a typical Highland area, and one which appears to be yearly growing in popularity; and the problem is therefore to show why the economic development of the area has been so insignificant as to allow of this secondary type supervening.

General Description of Region.

In order to focus the discussion, it is necessary to define exactly the area included in the following paper under the heading of Kingussie district. It is convenient for many purposes to take a civil parish as the unit, but this course has the great disadvantage that civil parishes only rarely have perfectly natural geographical limits. For example, the parish of Kingussie and Insh may be said in general terms to include a portion of the Spey valley, defined, broadly speaking, by two lateral tributaries, the Truim and the Feshie, and for much of its area by the watershed on the crest of the mountains which bound the valley on either side. Generally, therefore, the boundary lines may be said to be natural. On the other hand, the parish of Alvie, as it were, encroaches upon Kingussie and Insh in the vicinity of the hamlet of Lynchat, and cuts off from the latter parish a portion of the northern part of the main valley. In the following description, therefore, I have included with the parish of Kingussie and Insh, this part of Alvie, so that the area under consideration may be briefly defined as the part of the Spey valley which lies between the entrance of the Truim and that of the Feshie, and is bounded by the line of the watershed on either side. The accompanying map will show its limits.

The area of the parish of Kingussie and Insh is 114,049 acres, its greatest length from north to south is $19\frac{3}{8}$ miles, and its greatest width from east to west $15\frac{1}{4}$ miles. The portion of Alvie parish included with it in the following paper measures 11,475 acres, so that the total area under consideration here is 125,524 acres. The parish of Kingussie and Insh, it may be well to note, is in the southern part of Inverness-shire, its southern boundary forming part of the county boundary. It lies within the district of Badenoch. The latitude of the most northerly part of its boundary is 57° 10′ 35″ North latitude; the most southerly point is 56° 53′ 5″, while the extreme east and west points are respectively 3° 53′ 35″ and 4° 19′ 20″ West longitude. The northern position may be best realised by the fact that the longest day in lat. 57° N. (which is approximately the median parallel) has a length of 17 hrs. 39 mins., and the shortest of 6 hrs. 44 mins., as compared with a longest day of 16 hrs. 33 mins., and a shortest of 7 hrs. 45 mins. in London.

From the topographical standpoint the area defined above is of great simplicity, and may be said to consist of the river and its tributaries, the valley floor, and the mountain slopes which bound the valley on either side.

FIGS. 1 and 2.—Sections across the Spey Valley and the bounding hills, the lower along the line AB and the upper along CD on the Map. In each case the shaded section is drawn to true scale, while the other has the vertical heights exaggerated about thirteen times. Note the difference in the shape of the valley in the two cases.

It is not necessary to give any general description of the river Spey, for the river and its valley have been fully described in this *Magazine* by Mr. Hinxman.[1] His article is accompanied by a map of the Spey basin, and a diagram giving the profile of the river throughout its course. This diagram shows that in the area under consideration the river may be divided into two sections, according to the amount of fall. In the upper section, from the entrance of the Truim to a point near the village of Kingussie, the fall is relatively rapid, while from Kingussie onward the fall is very slight. About five miles below the village of Kingussie the river, which up to this point has meandered over a wide and flat valley floor, swells out into the little lake of Insh, which reaches a length of a mile. From this lake the river emerges with considerable velocity, to be joined, somewhat more than half a mile below, by the rapid Feshie. As Mr. Hinxman points out, the wide stretch of almost level ground from Kingussie to the beginning of Loch Insh is obviously an old lake bed, the present Insh being but the remnant of that older lake, whose waters once flooded the valley floor, and which has been gradually silted up by the river and its tributaries. Over this old lake floor the Spey now meanders sluggishly, but the silting up is of so recent a date that even now the slightest increase in the volume of water is sufficient to cause the river to overflow its banks, while a few days' rain will cause Loch Insh to spread to such an extent as to distinctly recall its predecessor.[2] To minimise this flooding the river is extensively embanked, and the physical geographer will doubtless regret that this and other signs of human interference have spoilt what would otherwise be beautiful examples of the evolution of "ox-bow" lakes.

The general course of the Spey in the area under consideration is from south-west to north-east, and as its wide valley is bounded by the Grampians to the south, and the Monadliath Hills to the north, it receives several important tributaries. With the exception of the Calder, the important tributaries, here as throughout the course of the river, come from the southern side. The two sections (Figs. 1 and 2) indicate the reason for this by showing that the southern range of hills reaches a greater mean height than the northern, and is, further, more extensive. The sections also illustrate another point of interest, and that is that, as a direct consequence of the different eroding powers of the two sets of tributaries, the river lies here nearer to the northern than to the southern side of its valley. The map shows at once why the Calder, though a northern tributary, yet reaches a considerable size, for it is obvious that for much of its course it runs roughly parallel to the Spey, behind the considerable mass of Creag Dhubh, and drains a large area of mountainous land beyond.

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1 *The River Spey*, by Lionel W. Hinxman, B.A., *S.G.M.*, xvii. p. 185.

2 According to Sir Thomas Dick Lauder's *Floods of Moray*, in the floods of August 1829 the meadows below Kingussie were flooded over an area of five miles by one mile, these figures being presumably exclusive of Loch Insh, whose dimensions are given as three miles by one mile. During the March floods of the present year (1906) it is stated that the whole valley was submerged from Newtonmore to Kincraig.

As tributaries on the southern side of the river we have the Truim, Milton burn, the Tromie, the Feshie, together with some minor streams. On the north there are the Calder, the Guinach, which runs through the village of Kingussie, the Raitts burn, a stream which runs into Loch Insh, and some insignificant burns. As regards the more important of the tributaries, and especially the Truim, Tromie, and Feshie, it is noticeable that they are rapid streams, and that, although none enters the main valley by a distinct hanging valley, yet each has very distinct falls and rapids on its course as it approaches the main valley. The Tromie, which enters between Kingussie and Loch Insh, must have been an important agent in the filling up of the old lake, and has a very distinct alluvial fan as it debouches on the plain.

If we turn our attention next to the valley floor, we find that the Spey valley, narrow above the entrance of the Truim, is for the most part wide and flat between the Truim and the Feshie, this being especially the case, as indicated above, between Kingussie and Loch Insh, where the former lake is represented by a series of flat swampy meadows, constantly liable to flooding (cf. Fig. 1). No part of the area lies below 700 feet, and the 800 feet contour-line crosses the Spey about three-quarters of a mile above Newtonmore Bridge. Only a relatively small area, and that only in the main valley (about 10·16 square miles or 6502 acres) lies below 800 feet; only about 19·11 square miles or 12,230 acres lies below 900 feet; and only 31·93 square miles or 20,435 acres below 1000 feet. Expressed in percentages, we find that only about 16·3 per cent. of the total area is below 1000 feet, about 9·7 per cent. below 900 feet, and about 5·1 per cent. below 800 feet. The land capable of cultivation, or of pasturing cattle, is confined to the main valley, and to strips in some of the lateral valleys. (Cf. p. 300.)

As regards human habitations, the main valley includes the villages of Newtonmore, Kingussie, Kincraig, and Insh. With the exception of Glen Truim, the lateral valleys only contain isolated houses, usually cottages or small farms round shooting-lodges. Glen Truim, which carries the main road and the railway, contains the small village of Dalwhinnie, which is included in the parish of Kingussie and Insh. In this connection it may be well to note that while the main valley is a wide *strath*, the narrow lateral valleys are merely *glens*.

The mountain walls which bound the valley, as already indicated, are a part of the Grampians to the south, and the Monadliaths (or Grey Mountains) to the north. In both cases the highest points only rise a little above 3000 feet, the amount of land above this height being small. Among the outstanding heights in the Grampians in the area under discussion are Carn na Caim (3087 feet), Carn Dearg Mòr (2813 feet), Bogha-cloiche (2945 feet). Of the Monadliaths, Creag Dhubh, the hill which lies to the west of Newtonmore, and is so conspicuous from the village, stands well apart from the rest of the range, from which it is cut off by the valley of the Calder, and thus, though it only reaches 2490 feet, is very noticeable. Another Creag Dhubh, also called Creag Mor, rises to 2581 feet, and is remarkable for its rocky southern side. It lies behind Kingussie. The largely fir-clad hill of Creag Bheag,

which only reaches a height of 1593 feet, lies immediately behind Kingussie.

Geology.

The geological map of the Kingussie district has not yet been published, but by the kindness of Mr. Lionel Hinxman, of the Geological Survey, I have been permitted to see the manuscript maps of the district. I am also indebted to Mr. Hinxman for a large amount of information in regard to the geology of the district, and it is upon this information that the following notes are based.

The rocks of the district belong, of course, to the Highland Metamorphic series, and consist of Moine schists and gneisses, which here, as elsewhere, give rise to poor soils, largely heather-covered. Into this series of metamorphic rocks, there have been intruded veins and sills of igneous rock, chiefly granite and pegmatite. The presence of these veins often affects the topography, in that the veins have craggy outcrops. The crags of Creag Mor (Creag Dhubh) and of Creag an Lòin are due to this cause. Other intrusions consist of porphyrite and other more basic rocks, and these are of some geographical importance in that, owing to the presence of phosphates, they make on decomposition a richer soil than the surrounding rocks. In consequence, these intrusions can sometimes be traced superficially by the band of richer vegetation which marks them.

The superficial deposits of the region are of glacial origin, and are very extensively developed. As to their texture, a point of considerable importance to the agriculturist, it is to be noticed that, as the rocks of the adjoining areas, as well as of the Kingussie district, are on the whole predominantly siliceous, the drift deposits tend to be of a sandy or gravelly character, the stiff tenacious boulder clays common in Carboniferous and Silurian areas being absent. On the other hand, as the schists vary in character, being in some places more argillaceous than in others, the drift deposits naturally also vary from purely sandy to partly argillaceous.

The distribution of the drift deposits is very interesting, for they occur high up the sides of the valley, and on the lower levels, while they are often absent on the steeper intervening slopes. The explanation of this fact is as follows:—"During the period of maximum glaciation the ground-moraine laid down by this ice-sheet must have covered the whole of the floor and sides of the valley. At a later stage, when the glaciers were greatly reduced in size, the Spey valley glacier would tend to erode the deposits of the earlier ice-sheet up to a certain height on the hill sides, leaving bare the steeper and more projecting portions of the lower hill slopes, and at the same time laying down fresh deposits on the valley floor." (L. H.) The high deposits thus indicate the level to which these later glaciers were unable to reach, while the areas destitute of drift indicate the areas which they denuded.

The upper deposits of drift are only of slight geographical importance. They often underlie later deposits of peat, but do not give rise to pastures of any importance.

In general terms, the whole of the area which can be said to be of any agricultural importance consists of drift and alluvium.

Very striking are the numerous mounds of sand and gravel to be found over much of the valley floor, and over its lower slopes. Some of these, as already explained in Mr. Hinxman's article, are terraces deposited between shrinking glaciers and the hillsides, others are remarkable in that they run up hill and not along the sides of the main valley. A good example

FIG. 3.—Glacial Mound near Kingussie, planted with larch.
The mound runs *up* the slope of the hill.

of the latter is the mound planted with larch immediately behind the hamlet of Lynchat (Fig. 3). Usually clothed with Scotch fir or larch, mounds of this type form important features of the landscape.

In Sir Archibald Geikie's *Scenery of Scotland* will be found some account of the glacial phenomena of the Spey valley, but it is sufficient for our purpose here to sum up the general facts as regards geological structure, in so far as they bear upon the economic possibilities of the region.

As mentioned above, the predominating rocks are such as give rise

to poor soil, and though the widespread covering of heather is perhaps to be ascribed rather to climatic than to purely geological conditions, yet the general poverty of the soil has a geological origin. To this statement the glacial and fluviatile deposits form an exception, for the soils to which they give rise, though light, are not unsuited to agriculture. Further, the absence of coal and of minerals of any importance are additional causes of the poverty of the district, while the absence of any considerable amount of limestone rocks facilitates the formation of peat, and helps to render the soil less productive, the rich pastures of limestone regions being here absent. Again, as we shall see later, the geological causes which have modified the course of the river Spey, have been powerful, if indirect, causes of the economic arrest of the region. Finally, the fact that the Kingussie district lies, roughly speaking, midway between the east and west shores of Scotland, and within the Highland line, means that it is surrounded by a vast area belonging to the Highland complex, all of which may be said in general terms to be a region of great natural poverty. It is the fact of the great uniformity of the area in which the district lies that makes a detailed study of so small a region of interest, for to a very large extent it is typical of much of the Highlands.

Climate.

(1) *Rainfall.*—Reference to Dr. Buchan's map [1] of the mean annual rainfall of Scotland will show that, while the upper part of the Spey valley generally lies in the area with a mean annual rainfall of 40 to 60 inches, yet the 30 to 40-inch area sends, as it were, a tongue along the Spey valley. It is this fact of the relative dryness, combined with the coolness due to elevation, which gives, as pointed out by Dr. Buchan,[2] the Spey valley area its delightful summer climate. The figures upon which the map just mentioned is based, include statistics for Aviemore, but not for Kingussie; but from figures of later date it would appear that the area of low rainfall must also include that village, and possibly Newtonmore also.

For Aviemore rainfall observations are available for long periods, and give a mean annual fall of 30 inches, the height of the station being 710 feet above sea-level.[3] For Kingussie the only complete figures of recent years are those for the nine years 1896-1904, too short a period to give accurate results. The actual mean fall for these years is 30 inches, while if the annual falls are corrected for the adjacent station of Inverness during the same years, the mean annual fall of Inverness being known, we find that the figure stands at 29 inches, the fall being thus approximately the same as that of Aviemore. It is unfortunate

[1] *Monthly and Annual Rainfall of Scotland*, 1866-1890 (with Plates), by Dr. Buchan. *Journ. Scott. Meteorol. Soc.*, Series III., x. p. 3.

[2] *The Mean Atmospheric Temperature of the British Islands*, by Dr. Buchan. *Journ. Scott. Meteorol. Soc.*, Series III., xiii. and xiv. p. 3.

[3] *Annual Rainfall of Scotland*, by Dr. Buchan. *Journ. Scott. Meteorol. Soc.*, Series III., xv. and xvi. p. 261.

that figures for Aviemore are not available for contrast during the years 1896-1904.

The rapid increase in the fall which takes place when one travels westward, may be realised by the rainfall of Laggan, which is 48 inches per annum, that is, 18 inches more than Aviemore, and this, although the distance between Kingussie and Laggan is less than that between Aviemore and Kingussie. Nor can the difference be attributed to elevation, for while the height of the Laggan station is given as 821, most of the Kingussie figures were taken at an elevation of 828, that is, presumably at some spot on the hill above the village street.

As there is apparently but little difference between the falls in Aviemore and Kingussie, it may be of interest to give here the main monthly rainfall for that place, as calculated by Dr. Buchan for a period of fifteen years.

TABLE I.

Mean Monthly Rainfall of Aviemore, 1876-1890.

Month.	Inches.	Month.	Inches.	Month.	Inches.	Month.	Inches.
Jan.	1·88	April	1·36	July	2·89	Oct.	3·19
Feb.	2·20	May	2·29	Aug.	3·05	Nov.	3·49
Mar.	2·55	June	2·29	Sept.	2·56	Dec.	2·31

These figures may be of some interest to those holiday-makers to whom the wetness of each successive August comes with the shock of a new and unpleasant surprise, for they show that August is the third wettest month of the year, being one of the three in which the mean fall exceeds 3 inches. Again, they show that April is by far the driest month, being one of the two in which the mean fall is less than 2 inches, and the only one in which it is less than 1½ inches.

The figures for Kingussie give somewhat different results, though it is impossible to say how far this is due to the fact that they are based upon a much shorter period (see Table II. p. 294).

As will be seen from this table, August is again the third wettest month of the year, but only December has a fall exceeding 3 inches, and only May, which is here the driest month instead of April, a fall of less than 2 inches.

It is unfortunate that there are so few statistics available for the district generally, for, like all hilly regions, showers are often of very local distribution, it being not infrequent to see one side of the valley wrapt in mist and driving rain, while another part is in the enjoyment of bright sunshine, and it would be interesting to find out how far these inequalities are compensated for in the total fall.

As statistics of rainfall in themselves only appeal to the professed meteorologist who has a basis of comparison available, it may be of interest to compare the Kingussie figures with those for Edinburgh, and thus to indicate the notable climatic differences between the two places. In the following discussion I have taken the figures obtained at the Leith Nautical School, as for the given period the only choice is

between these figures and those obtained at the Royal Observatory, Blackford Hill, where the height renders the figures not a fair basis of comparison for the residential parts of the city.

The station of observation at Leith is 70 feet above sea-level, and the mean annual rainfall, as determined over a long period, is 26 inches

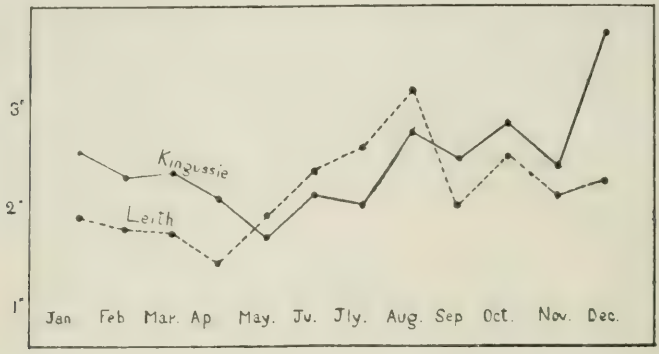

FIG. 4.—Curves showing the Mean Monthly Rainfall at Leith and Kingussie.

per annum as compared with the 29 calculated above for Kingussie. The difference in the total fall is therefore not very marked, but it is interesting to note that there is a considerable difference in the monthly falls. This may be most clearly appreciated by a study of the accompanying diagram (Fig. 4) and table.

TABLE II. (FIG. 4.)

MEAN MONTHLY RAINFALLS OF LEITH AND KINGUSSIE, 1896-1904.

	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Leith, .	1·96	1·83	1·81	1·48	1·96	2·41	2·68	3·30	2·09	2·61	2·17	2·34
Kingussie,	2·62	2·34	2·40	2·14	1·73	2·19	2·08	2·83	2·57	2·91	2·47	3·87

The figures are in inches.

The diagram brings out the rather interesting fact that the rainfall of Kingussie is actually less than that of Leith during the months of May, June, July, and August, the excess fall at Kingussie occurring during the winter months. Indeed, if we contrast the falls during the months April to September, we find that the Kingussie average works out at 13·54 inches, as against 13·92 for Leith. On the other hand, taking the months from October to March, the Kingussie fall is 16·61 inches, while that of Leith is only 12·72. These figures afford an interesting illustration of Dr. Buchan's statement that the summer

climate of Speyside is comparatively dry, and helps to account for its popularity.

But the unlucky tourist who has spent an August on Speyside only to experience rain, with rare exceptions, every day of his holiday may be disposed to say that these figures give too optimistic a view of the summer rainfall. It is therefore of some interest to look at the distribution of the rainfall throughout the months—that is, to note the number of days with rain. The following table gives the averages for the years indicated, and these are also shown on the curve.

TABLE III.

AVERAGE NUMBER OF DAYS WITH RAIN IN LEITH AND KINGUSSIE, 1896-1903. (The results are given in the nearest whole number.) (FIG. 5.)

	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Leith, .	17	13	18	16	14	15	17	17	17	18	15	20
Kingussie,	16	11	20	18	17	16	16	20	19	20	17	19

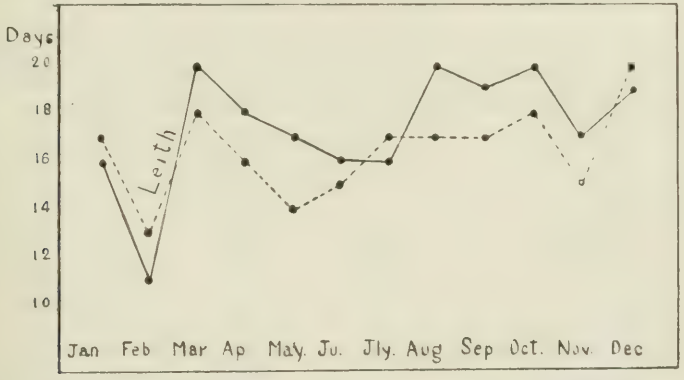

FIG. 5.—Curves showing the average number of days with rain per month in Leith and Kingussie.

This curve should be compared with that of the rainfall, and will show, among other points, the somewhat curious fact that, although the rainfall of Kingussie during the month of August is less than that of Leith, yet Kingussie has more "rainy days" in August than has Leith. In the eight years under consideration the average number of days with rain at Kingussie is 20 as against 17 at Leith. The maximum number of days was 27 and 22 respectively, and the minimum 16 and 9. On the other hand, the average fall per day was ·20 at Leith, as against only ·14 at Kingussie. In other words at Leith in August, rain when it occurs is

heavier or more continuous than rain at Kingussie, but, looking at the average number of days with rain at Kingussie, it is obvious that there is one article of dress which the tourist will be ill-advised to omit from his baggage.

From the botanical standpoint, one should notice that the rainfall is fairly equally distributed throughout the year—the condition most favourable for the formation of peat—and that in the light sandy soil of the region there is risk of deficiency in amount during the months when growth is most rapid. In these respects, therefore, the conditions are unfavourable for agriculture, as the plants upon which the farmer depends demand much water in the growing season, and are unsuited to the conditions which favour growth of peat (see below, p. 307).

(2) *Temperature.*—In an article by Dr. Buchan (cf. p. 292, footnote 2), the mean monthly temperature of Kingussie is given in a table showing the mean monthly temperature of a number of places in Scotland for the forty years 1856-95. For the sake of contrast I have plotted these figures against those given for Leith in the same paper. The resultant curve shows that the temperature of Kingussie[1] is lower than that of Leith throughout the whole year, the difference being greatest in February and least in May, with a respective maximum and minimum difference of 3·6° and 1·4°. During the three summer months of June, July, and August, the difference is constantly 2·3°. For purpose of reference the actual figures are given below.

TABLE IV. (Fig. 6.)

Mean Monthly Temperature of Leith (height of station, 70 feet) and Kingussie (height of station, 824 feet).

Month.	Leith.	Kingussie.	Difference.
	°	°	°
January, . .	38·6	35·3	3·3
February, . .	39·6	36·0	3·6
March, . . .	40·6	37·2	3·4
April, . . .	44·8	41·3	3·5
May, . . .	49·4	48·0	1·4
June, . . .	55·8	53·5	2·3
July, . . .	58·2	55·9	2·3
August, . . .	57·5	55·2	2·3
September, . .	54·1	51·2	2·9
October, . .	47·3	44·6	2·7
November, . .	42·0	38·9	3·1
December, . .	39·2	36·3	2·9
Mean Annual, .	47·2	44·5	2·7

Note.—The temperatures are Fahrenheit.

As will be seen from this table, the mean annual temperature of Kingussie is 44·5° F. (or 6·9° C.), as contrasted with 47·2° F. (or 8·4° C.) at Leith.

In more recent issues of the *Journal of the Scottish Meteorological Society*

[1] The figures for Kingussie are stated by Dr. Buchan in his paper to be based upon a shorter period than forty years.

than that referred to above, complete temperature returns for the Kingussie station for the years 1896-1902 inclusive are given. With regard to these figures, it is interesting to note the minimum temperatures, which

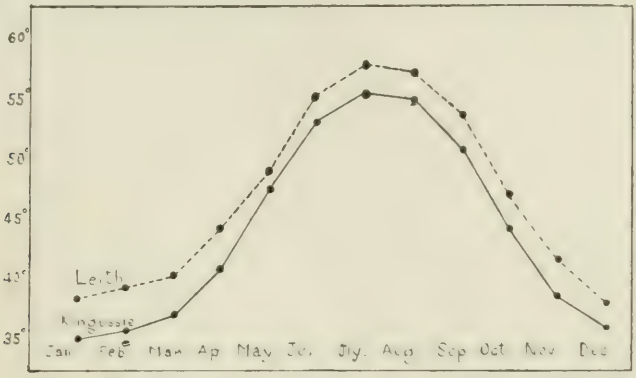

FIG. 6.—Curves showing the Mean Monthly Temperature of Leith and Kingussie.

during the growing season have, of course, an important bearing on agriculture. Without going into full details, the following statement as regards the occurrence of frosts may be found interesting.

During the seven years referred to, frost occurred every year in all the months from October to May inclusive. In five out of the seven years there was frost in September. In one year there was frost in June, and while, though there was no actual frost in the months of July and August during the years indicated, the fact that in one year the temperature fell to 32·2° in July, and to 32·4° in August, suggests that a longer series would show that frost may occur in these months also.

From the agricultural standpoint these figures hardly require comment. Habitual May frost means, of course, a very late spring, and with the probable onset of frost in September, it is obvious that at best the agriculturist can only hope to wring from reluctant nature a harvest of the hardiest crops. So far as temperature is concerned, then, there is no difficulty in seeing why the economic development of the district has been delayed, or why the inhabitants prefer to cultivate the tourist rather than grain.

On the other hand, the figures for the summer months ensure the tourist against oppressive heat, the temperature, as Dr. Buchan points out, not normally rising to such a height as to render active physical exercise irksome.

(3) *Humidity.*—As the Kingussie district has of late years acquired a considerable reputation as a health resort for the treatment of chest complaints, and as there is a consensus of opinion that in the case of such complaints a dry atmosphere is very important, it is of interest to look at the statistics relating to humidity. We may take, first, what the meteorologists call relative humidity. This is the ratio of the moisture actually present in air of a given temperature to the amount of moisture

which would produce saturation at this temperature, and is expressed as a percentage. It is the relative humidity which is responsible for our sensations of dryness or dampness in relation to air. Taking the years 1896-1903, for which full records have appeared, we may compare the mean monthly humidity for Leith and Kingussie. The following table and the accompanying curve show the result, and it will be seen that during the months of June, July, and September the air of Kingussie feels drier than that of Leith; during August the humidity is about the same, and for the rest of the year it is greater at Kingussie. Generally, we may say that the relative humidity of Kingussie is less than that of Leith during the warm months and greater in the cold. These figures, in short, when taken in conjunction with the figures for temperature, give a statistical reason for the well-marked physiological change which most people experience on changing the climate of Edinburgh for that of Speyside in, say, July. On the other hand, the humidity during the colder months of the year is considerable, and it seems doubtful if those whose health requires a dry atmosphere will derive much benefit from a stay in the district during the months from October to March inclusive.

TABLE V. (Fig. 7.)

Mean Monthly Humidity, 1896-1903.

The figures are percentages.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Kingussie,	85·6	87·9	85·4	80·2	76·2	74·7	76·9	79·9	80·6	85·4	86·9	86·5
Leith, .	84·1	82·1	79·9	76·7	75·6	78·2	77·6	79·6	81·1	81·6	85·0	84·9

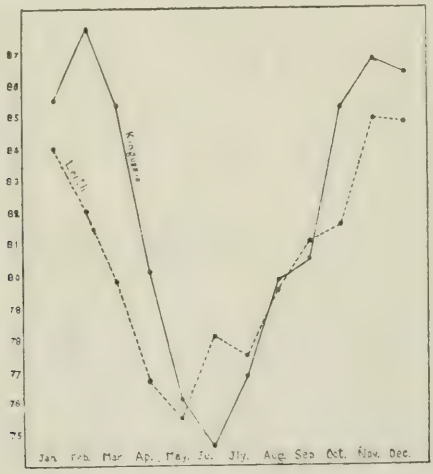

Fig. 7.—Curves showing the Mean Monthly Humidity at Leith and Kingussie.

A comparison of the absolute humidity, that is, of the pressure of water vapour in the two localities throughout the year, gives somewhat different results, as the accompanying table and curve will show. The pressure of water vapour is there seen to be less at Kingussie than at Leith throughout the year, the difference being greatest in July, August, and September, and least in December.

TABLE VI. (FIG. 8.)

MEAN MONTHLY PRESSURE OF WATER VAPOUR, 1896-1903.

The figures are in decimals of an inch.

	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Kingussie,	·177	·179	·186	·211	·246	·316	·347	·340	·304	·242	·217	·198
Leith, .	·208	·199	·207	·232	·267	·339	·387	·380	·345	·276	·249	·215

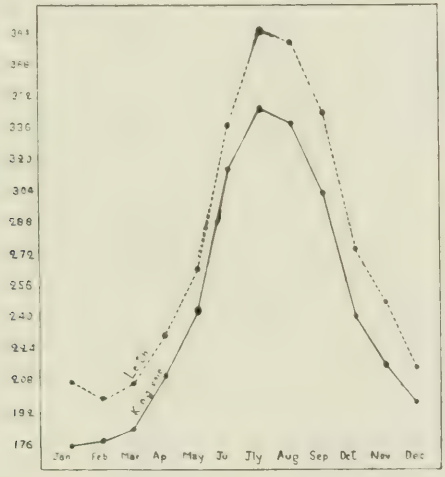

FIG. 8.—Curves showing the Mean Monthly Pressure of Water Vapour at Leith and Kingussie.

The prevalent *winds* are westerly, the most frequent directions being *west* and *southwest*. Winds with an easterly component are uncommon, this being especially true of the direction *east*.

THE NATURAL RESOURCES.—THE LAND.

In the 6-inch Ordnance Survey maps of the Kingussie district (surveyed, however, so long ago as 1867-70), the nature of the land-surface is, as usual, indicated in some detail. Thus, a blank surface indicates that the area is cultivated, or capable of cultivation: parks are

shown by special markings; woods are indicated as deciduous or coniferous; bogs and swamps are marked; while the greater part of the region under consideration is shown as uncultivated land, much of it being rocky as well as heather-covered. In measuring the areas of the different types of land with the planimeter on the map, I have recognised three categories only:—(1) Cultivated land, including all that is shown blank on the map, as well as grass parks (which in the sheets concerned cover only a very small area), and also the ground covered by the villages. The latter are small and few, and include a considerable amount of garden ground, so that the error introduced is small. (2) Woods, distinguished as (*a*) Coniferous and mixed; and (*b*) Deciduous. (3) All the remainder, whether bog or heather-covered moor, has been simply reckoned as waste land.

(1) *The Cultivated Land.*—When measured in the manner indicated above, we find that only about 6902 acres (or nearly 10·8 square miles) of the total area of 125,524 acres is neither waste nor covered with woodland. This gives us 5·5 per cent. of the total, a figure which agrees very closely with those for the county as given in the Agricultural Returns for Scotland for the year 1905. The county of Inverness has a total land area of 2,695,037 acres, and of this total 148,189 acres only (or 5·5 per cent.) are returned as cultivated during 1905, being a decrease of 700 acres on the figures for 1904.

As parish returns are not given, it is impossible to find out for the Kingussie district what crops are grown, or what amount of the area which the map shows to possess the possibility of cultivation when the survey was made is now actually cultivated, but the following table showing the crops grown in the county is of interest in this connection:—

TABLE VII.

Crops and Grass in the County of Inverness, 1905.

Crop.	Acres.	Percentage of cultivated land.
Permanent pasture, . .	61,577	41·5
Grasses, etc., in rotation, .	30,633	20·6
Oats, ...	30,057	20·3
Potatoes, turnips, and swedes,	16,806	11·3
Other crops, (especially barley) and bare fallow, . . .	9116	6·3
	148,189	100

From personal observation in the Kingussie district and these figures, it may be assumed that the cultivated land in the district, *i.e.* the land under grass and crops, is devoted in the order of importance to permanent grass, grasses in rotation, oats and root crops. Of the 22 acres of wheat returned as grown in Inverness-shire in 1905, it is safe to assume that none was grown in the Kingussie district. In the county

generally there were, in 1905, 527,632 sheep, which works out at about six per head for the county population.

As to the position of the land capable of cultivation, by far the largest area is that formed by the old lake bed between Kingussie and Insh, but, in spite of the embankments, a large part of this area is periodically flooded. In consequence, the grass with which the area is covered grows coarse and rank. To any one who has passed through

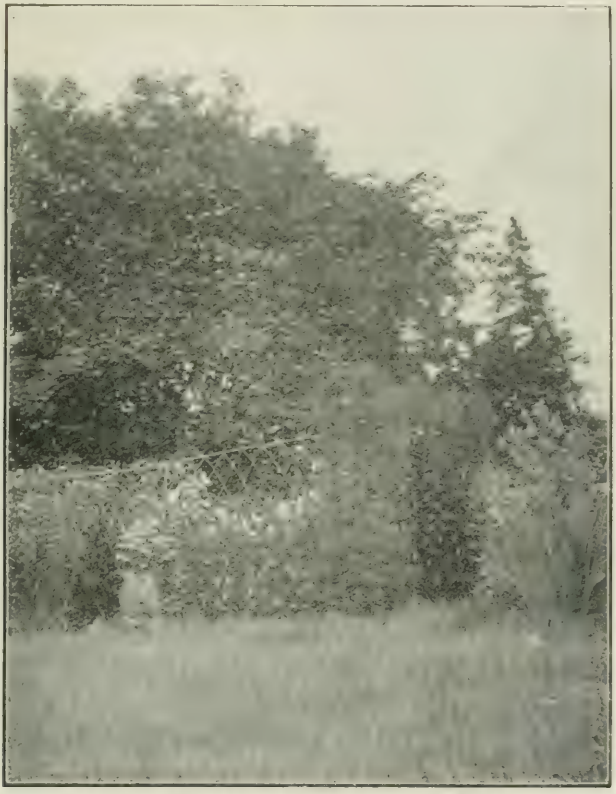

Fig. 9.—A Kingussie garden.

Holland, the problem of how to prevent this flooding does not appear insoluble, and it can hardly be doubted that means could be devised to convert the whole area into fertile arable land. (Cf. *The River Spey*, *S.G.M.*, xvii. p. 189.) Meantime it grows for the most part only natural grass.

As already indicated, the soil in the lower grounds is not infertile, though from its porous nature the crops are apt to suffer severely from drought, if rain is deficient during growth. The gardens round the cottages and houses built for summer letting often display luxuriant vegetation (Figs. 9 and 10), and such shrubs and plants as roses, honey-

suckle, clematis, mock orange, red-berried elder, spireas, monkshood, larkspur, peony, golden rod, lilies, and so forth, which flourish in great profusion, indicate that the land can be made to produce freely. This is often very striking in the case of the newer houses, where gardens just taken from the rough hillsides are gay with annuals and perennials, sometimes growing literally side by side with the heather. In this connection one should notice, however, that the fact that the horse is a

Fig. 10.—Cottage and garden near Kingussie.

very important transport animal in the locality, has a considerable bearing upon soil fertility, in that it leads to an abundance of manure. It is rather a gloomy thought that the innumerable motor-cars which race up and down the narrow tortuous roads in summer-time may in the future rob the local gardens of half their beauty.

To sum up, the small relative importance of agriculture in the district, as in the county, is in large part to be ascribed to the surface relief, and the other conditions which make so much of the land useless. It is further in part, as already seen, to be ascribed to the climate, which is unfavourable to the growth of many crops, but here, as elsewhere,

it is probably also in part to be ascribed to conditions not purely economic.

(2) *The Woodlands.*—The total area covered by wood in the Kingussie district, as calculated on the 6-inch map, is 5003 acres (7·8 square miles), that is nearly 4 per cent. of the total area. Of this total the deciduous woods cover 3318 acres, or 2·6 per cent., and the coniferous and mixed 1685 acres, or 1·3 per cent. Comparing these figures with those given in the Agricultural Returns for the county, we find the total area covered by woods, plantations, and coppice in Inverness-shire to be 145,629 acres, or about 5·4 per cent. of the total area. Thus the woods in the Kingussie district are somewhat below the average for the county. A comparison on the spot with some of the more easterly parishes bears this out, for the Kingussie district does not contain the magnificent fir-woods to be found, for instance, in the Rothiemurchus district.

The coniferous woods consist, for the most part, of Scotch fir and larch, trees which form important elements in the landscape, but there is a certain amount of spruce fir, and round the shooting-lodges and the larger houses a number of beautiful exotic conifers have been planted in small numbers. The deciduous woods bulk much more largely on the map and in figures than in the field, for they consist for the most part of birch, and, up the sides of the streams, of alder (Fig. 11), the resultant "wood" being often not much more than a thicket. A certain amount of mixed deciduous wood (oak, etc.,) does occur, as, for example, along the side of the main road in the vicinity of the mansion of Balavil; and, though it is not numerically important, it is impossible on æsthetic grounds to omit the mention of the rowan or mountain ash, whose autumnal crown of berries makes it one of the glories of the Highlands.

As regards the height to which the woods ascend, while Mr. Robert Smith [1] gives 2000 feet as the height to which patches of birch ascend in Perthshire, in the Kingussie district it would appear only occasionally, as on Creag Dhubh, to rise above the 1750 line. It is rather interesting to notice the great abundance of juniper, both as undergrowth in the birch woods, where these are not too thick, and as forming a zone above the birches and before the beginning of the heather. Though usually bush-like in growth, this plant not infrequently grows to a few feet in height, presenting the appearance of a small fir-tree. On the lower slopes of the hills behind Lynchat, for example, it is very abundant.[2]

(3) All the remainder of the surface, including some 89 per cent. of the area, is waste land, largely heather-covered. The papers of Messrs. R. and W. Smith [3] in recent issues of the *Magazine* have given detailed descriptions of the flora of some of the heather-covered regions of Scotland, so that it is only necessary to sum up here the general characters

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[1] *Botanical Survey of North Perthshire, S.G.M.*, xvi. p. 441.

[2] In connection with the woods it is interesting to note the great abundance of the wood or red ant (*Formica rufa*), whose large mound-like nests with their radiating paths are very common objects both in the birch and coniferous woods.

[3] See above, footnote 1; also *Botanical Survey of Edinburgh*, xvi. p. 385; and *of Forfar and Fife*, xx. p. 617, and xxi. p. 1, and cf. Dr. Marcel Hardy's paper (p. 229) and map.

of such areas in their bearing upon the utilisation of the soil. The following account is based upon the various researches which have been made of late years in regard to these regions.

Before entering into a discussion of the general characters of the hill slopes, however, it may be well to explicitly state that much of the area marked on the map as useless lies at comparatively low levels, as

Fig. 11.—The woodlands of Kingussie—view in the Calder Valley. The trees are for the most part birch, but there is an intermixture with alder by the side of the river. The sheep on the flood plain near the river had been brought down from the hills for dipping—hence their numbers.

for example, on the valley floor, and is useless because it is swampy, undrained, and constantly liable to flooding when the river is in spate. This type, which is sometimes sprinkled with juniper bushes, and usually with rushes and coarse grasses, is more or less utilised as pasture ground, and is excluded from the description which follows, which refers only to the hill slopes.

Various classifications have been proposed for the zones of vegetation to be observed on such hills as those forming the Scotch Highlands, the

classification varying according to the purpose which the various authors have in view. For our purpose here it is sufficient to recognise three types:—(1) Mountain pasture, (2) heath, (3) Sphagnum moor.

In all three regions the plants, so far as the writer's observations go, show a strong resemblance to those described by the late Robert Smith in North Perthshire. See also Dr. Hardy's map, where the region called here *Mountain-pasture* is divided into *Mountain-pasture* and *Dry Grass Moor*.

(1) In the mountain pasture region, grasses predominate, and though heather and heath also occur, the plants are small. Mingled with the grasses are such plants as dwarf willows, meadow gentian, often very abundant, eyebright, milkwort, *Potentilla sylvestris*, the pretty little Trientalis, and in the wetter places, bog asphodel, sundew and Pinguicula. Bracken is also sometimes abundant, and in places, as for instance in the valley of Allt Mor behind Kingussie, great sheets of mountain shield fern (*Lastrea oreopteris*) occur.

(2) The heath or true heather region largely predominates, and is very uniform over great areas (Fig. 13). The predominating plants are heather, bearberry (*Arctostaphylos uva-ursi*), the cowberry (*Vaccinum vitis-idæa*), which so curiously resembles the bearberry, the heaths, the Club-mosses, while the blaeberry is less common. In the damper regions, especially on the lower slopes of the hills, a considerable amount of bog-myrtle occurs, mingled with rushes, sedges, cotton-grass, bog asphodel, and so on. It is on these lower slopes also that the juniper grows, though, as already mentioned, it is also found in the woods.

(3) The Sphagnum moor, or high moor of Schimper, is inconspicuous; in it the predominant plant is Sphagnum or cotton-grass (*Eriophorum*), but sedges, with other bog-plants, also occur.

In all these three regions the soil is characterised by the presence of some amount of peat, the amount being greatest in the case of the Sphagnum moor, and least where grasses predominate, and it is the presence of this peat which makes the soil so difficult of utilisation by man. The peat is therefore responsible to a large extent for the poverty of the region. The reason why a peat soil is unsuited to the growth of the plants upon which man depends directly (*i.e.* as food) or indirectly (*i.e.* as fodder), requires some little consideration. Vegetable matter which has been buried in soil which is well drained, and consequently well aerated, is as a rule acted upon by bacteria, and apparently also by fungi, with the result that decay occurs, and the organic compounds are ultimately broken down into carbonic acid, water, ammonia, nitrogen gas, and mineral salts. If bases are present in the soil in addition to oxygen and water, the ammonia as it is liberated is laid hold of by nitrifying bacteria, and is ultimately built up into nitrates. It is these nitrates which form the ordinary supply of nitrogen for most plants, and therefore, before the ordinary farm crops can flourish, the soil (1) must be supplied with organic matter; (2) it must be well aerated so as to permit of the development of the organisms which give rise to decay; (3) it must contain nitrifying bacteria; and (4) a sufficiency of mineral bases. In fulfilling the last condition earthworms in the soil are of great importance, for the result of their action is to cause an inter-

mingling of the mineral elements of the soil with the organic particles. Now, where peat is formed, none of these conditions are satisfied, save the first: the soil contains an abundance of organic matter, but it is so waterlogged that the free access of air is prevented; on account of the absence of air it does not contain nitrifying bacteria, and it is remarkably deficient in mineral bases, which is in part to be ascribed to the absence of earthworms. In consequence, organic matter introduced into

FIG. 12.—View in the Upper Calder Valley—a typical moorland scene. The bushes are alder; in the background morainic mounds are conspicuous. The view is taken higher up the valley than Fig. 11.

such a soil does not undergo decay, but the quite different process of humification. It is acted upon largely apparently by anæobic bacteria (*i.e.* forms which thrive in the absence of free oxygen), and as the result of their action becomes dark in colour, gives off by a process of fermentation carbonic acid, marsh gas, and hydrogen; but whereas in the process of decay chemical change goes on until only simple inorganic products remain, in this process of putrefaction, as it is called, there is an early arrest of change, and a substance called humus is formed. This substance is richer in carbon than the vegetable matter from which

it arose, and contains a varying amount of nitrogen. Peat is essentially acid humus, and is characterised by its great chemical stability. It oxidises with extreme slowness, and has marked antiseptic properties, so that it is not a suitable nidus for the growth of bacteria. Although it may be even rich in nitrogen, yet this is present in so intractable a form that it is absolutely useless for ordinary farm crops, which die of nitrogen starvation if planted in it.

But it may justly be observed that peat soils are not absolutely barren; they do support abundant vegetation, so that the next point to be considered is how the characteristic plants of peat soils manage to obtain their necessary supplies of nitrogen.

It is a general rule that plants are incapable of utilising raw humus, which must undergo the complicated series of changes outlined above before it is utilisable. But to this rule there is one notable exception. Certain fungi whose mycelia ramify throughout the soil seem to possess the power of directly utilising the humus. Now most of the higher plants which grow in soils rich in humus have been shown to possess on their roots symbiotic fungi (*mycorhiza*), which enable them to utilise the raw humus of the soil. Mycorhiza of this type have been shown to exist on the roots of many trees, and of plants inhabiting woods, and they are apparently nearly universal on plants which flourish on peat. Where the plants of the moors, taking the word in the large sense, have not mycorhiza on their roots they may supplement the meagre amount of nitrogen obtainable in one of two other possible ways:—they may be partial parasites, like eyebright, which obtains at least part of its food from grasses to whose roots it attaches itself; again, like the sundew and pinguicula of the bogs, they may get additional nitrogen by capturing and digesting insects with their leaves. Now, the plants which are useful to man as farm crops are not plants furnished with mycorhiza, they are not parasites, and they are not carnivorous. Therefore a peaty soil is unsuited for their growth. But it may be repeated, this unsuitability is not because of the absence of the necessary nitrogen in the peat soil, but because of its presence in a form in which it cannot be utilised.

We have already explained that, partly because of the want of intermixing of the surface and deeper layers of the soil in peat-covered areas, the surface is poor in mineral salts. In many cases, at least, it is found that the process of intermingling is further hindered by the development of a hard layer of "pan" below the organic layers of the soil. Some account of this process of pan formation is given in an article by Dr. W. G. Smith in the *Magazine* (xviii. p. 587) on Graebner's *Die Heide Norddeutschlands*; it appears to be largely due to the interaction of iron salts and the humic acids, and the subsequent precipitation of hydrated oxide of iron (cf. Hall, *The Soil*). This pan is another obstacle in the cultivation of peat soils.

The article by Dr. Smith mentioned above discusses the probable causes of peat formation. It would appear that climate is at least one of the most important of these. There must be a fairly large rainfall, and this must be so distributed that the summer evaporation is not

sufficient to balance the summer fall, so that the soil never becomes properly dry. (See also Graebner's book.)

There is, however, no doubt that by proper treatment a peat soil can be reclaimed. It must be drained to cure the waterlogging, if necessary the pan must be broken up by deep ploughing, the acidity must be cured by lime, and it will also be necessary in most cases to add mineral manures to make up for the natural deficiency in mineral matter, though

FIG. 13.—View in the Tromie Valley—showing alder by the stream and heather in the background.

in some cases this deficiency will doubtless cure itself if the natural free interchange between the upper and lower layers of the soil can be promoted. It is of some importance to note that oats and potatoes, the crops which we have shown above to be grown predominantly in Inverness-shire, are the crops which are most tolerant of a soil recently reclaimed from a peaty waste.

The fact that so little attempt is apparently at present being made to reclaim the peat wastes of the area under consideration is no doubt partly due to the fact that cultivators of the soil are handicapped, as com-

pared with other parts of the country and of the world, where the soil is more readily utilisable, but is also partly due to social causes. It is of some interest to note that the soils of the much-vaunted country of Rhodesia, according to a recent account in this *Magazine* (p. 47), show, though for a different cause, the same absence of nitrifying bacteria as peat. In conclusion, we may repeat that in the peat-covered lands of the Highlands of Scotland—meantime so little utilised—there lies locked up an incalculable treasure in the form of that organic nitrogen which is one great source of soil wealth.

In connection with the utilisation of the surface of the land, an interesting point is the area of the deer forests. The Annual Return for 1904 gives a total of 1,033,329 acres in the county of Inverness as being occupied by deer forests, this being an increase of 103,286 acres since 1898. Taking the total land area of Inverness-shire at 2,695,037 acres, we find that 38·3 per cent. of the total area is cleared for deer. In this connection it must of course be realised that "forest" is here a technical term, and has no relation to the covering of the land (contrast the figures for the total woodlands given above). It is not easy to calculate exactly the percentage of deer forest in the Kingussie district as defined above, but the forests of Gaick and Glentromie (returned as *Gaick, Glentromie, and Part of Killichuntly*, 26,200 acres), and a part of the extensive Glenfeshie forest (returned as *Part of Glenfeshie and Part of Killichuntly*, 35,900 acres, and *Part of Glenfeshie*, 5599 acres) are included in the area, and the figures suggest that the percentage cannot be less than that for the county generally. The three forests named are assessed at the considerable sum of £6878.

Apart from the land surface the natural resources are almost *nil*. There is a certain amount of water power, whose utilisation takes the primitive form of mills, conspicuous in many of the lateral valleys, but no minerals of any account are present.

The Population.

In the following discussion of the population, the parish of Kingussie and Insh has been taken as the basis, in preference to the larger district treated of in the earlier part of this paper, whose population can only be slightly larger.

According to the census of 1901, the population of the parish of Kingussie and Insh is 2194. Of this number 989 live in the burgh of Kingussie, nearly 500 of the remainder in Newtonmore, and the remaining seven hundred odd in the scattered hamlets, outlying cottages, etc. Taking the area of the parish as equal to 178·2 square miles, we find that the density of the population per square mile is 12. The significance of this figure may be appreciated by comparing it with those for the county and for other parts of Scotland. Taking the whole of Scotland, we find that the average density of population is 150. The smallest average is found in the county of Sutherland, where it is only 11; the county of Inverness comes next with 21; while Lanark heads the list with no less than 1523 persons per

square mile. It will be seen that the density in Kingussie parish is low, as compared even with the county. On the other hand, it should be noticed that of the 90,104 people who inhabit Inverness-shire, no less than 23,066, or 25·6 per cent., are found in the town of Inverness, and it is this figure which inflates the general county average. The low general average in the county, and also in the parish, emphasises the facts already put forward as to the poverty and arrested development of the area, while the scanty numbers of the human inhabitants as compared with the huge area devoted to deer forests, has given origin to the common complaint that in the Highlands of Scotland there is room for deer but not for men.

But, as has been already pointed out, the recent development of Speyside as a health resort has induced what may be called a secondary type of development in the area, and this development is reflected in the changes of the population in recent years. If we take only the comparison of the figures for 1891 with those for 1901 we find that, while over the whole county of Inverness-shire there is a decrease in the population to the extent of ·02 per cent., in the parish of Kingussie and Insh there is a well-marked increase. In 1891 the total population of the parish was only 1941, giving an increase of 253 or 11 per cent. in the decennial period. That the increase is directly associated with the development of the district as a health resort, is at least suggested by the fact that it is most marked in the villages of Kingussie and Newtonmore, where the new houses have been admittedly built for summer letting. In 1891 Kingussie had only 740 inhabitants, the increase being thus 249, or nearly 34 per cent. in the ten years. For Newtonmore the 1891 figure is 364 as compared with 478, an increase of 114 or 31 per cent.

The increase in the population is naturally reflected in the increased number of houses in the parish, and especially in the rapidly developing village of Kingussie. This is well shown by the figures given in the census returns. Thus in 1891 the total number of houses in Kingussie, including those inhabited, vacant, and in process of being built, was 174, while in 1901 it was 249, an increase of 65 during the ten years. For the whole parish the increase was 73. According to local statements, something like £160,000 have been spent on building operations in Kingussie and Newtonmore during the past fifteen years.

Another point of some interest is the number of persons speaking Gaelic. Out of the 2194 inhabiting the parish, only seven are returned as only Gaelic-speaking, but 1191 or 54 per cent. speak Gaelic as well as English. In the county as a whole 13 per cent. speak Gaelic only, and 48 per cent. speak Gaelic and English, so that relatively to the rest of the county the parish has become "anglicised."

As regards the proportion of the sexes, the females are in considerable excess, a fact doubtless due here to the natural poverty of the region, which causes the males to emigrate. In Scotland generally there are 105·7 females to every 100 males, but in the parish of Kingussie and Insh there are 111·6 females for every 100 males. This

is considerably higher than the figure for the county, which is practically the same as that for Scotland generally.

The census report does not give statistics of occupations for the villages or parishes, but the figures for the county are interesting as serving to emphasise the agricultural character of the community. Of the total population of the county over ten years of age, 80 per cent. of the males are occupied, and 34 per cent. of the total males, or nearly half those occupied, are busied with agriculture and fishing, as against 26 per cent. who are engaged in industrial occupations.

Means of Communication.

In connection with the means of communication, it is important to realise from the first the economic uselessness of the river Spey. Mr. Hinxman in his article has explained that the existing Spey is made up of two sections of very different geological age, and in consequence, while it is sluggish in the vicinity of Kingussie, it is an exceedingly rapid river in its lower reaches. So rapid is the fall near the mouth that the tides are unable to ascend more than a short distance. In consequence, unlike the other great rivers of Scotland, the Spey has no port at its mouth, and it is not too much to say that much of the poverty of Inverness-shire is due to that earth-movement which led to the rejuvenation of the lower part of the Spey valley. Further, this has an important bearing upon the roads of the county. In Kingussie parish road and rail follow their natural course and run parallel to the river, but not far outside its limits both leave the river to turn northwards to Inverness, instead of following their normal course in the case of a large river and accompanying it to its mouth. What significance the valley at Kingussie possesses as a trade route is therefore connected with the fact that it is the natural direct line of connection between the Lowlands and Inverness and the North.

A mere glance at the map is required to show that the portion of the Spey valley near Kingussie is clearly on the main route to the north. The considerable bend to the eastward taken by Aberdeenshire makes the coast route excessively long, while the great mountain mass of the Grampians renders a direct road between Perth and the north an impossibility.

The basis of the existing means of communication is one of General Wade's great military roads, constructed with a view to the subjugation of the Highlands after the rebellion of 1715. It will be recollected that as a part of the military scheme a chain of forts—Fort William, Fort Augustus, and Fort George—was erected along the line of the Great Glen, and in connection with these an elaborate series of roads was constructed. One of these was the great road from Perth to Inverness, and it is this road which traverses the valley of the Spey from the entrance of Glen Truim onwards to the limits of the region under consideration. From Perth to Blair Atholl this road has a general north-westerly direction, but at the latter place it turns almost directly west, to pass up Glen Garry, and crosses the considerable pass of Drumochter,

to be continued onwards past Dalwhinnie down Glen Truim. On leaving Glen Truim it crosses the Spey near Newtonmore to the northern side, and then runs down the valley parallel to the river, the course of General Wade's original road having been here slightly modified. The Highland railway runs parallel to the road, and, as the change in direction at Blair Atholl indicates, affords a somewhat circuitous route to the north. A glance at a topographical map of Scotland will show that in general terms the bend to the west made by road and rail is due to the high ground of the Grampian chain to the east, but it is of some interest to note in detail why both follow Glen Truim in place of the other glens which open into the Spey valley in the vicinity of Kingussie. As the map shows, both Glen Tromie and Glen Feshie carry roads of a primitive type, and either of these forms a more direct route to Perth than the road up Glen Truim. But while the road up Glen Truim barely reaches the 1500 feet contour-line, the road up Glen Feshie along the Geldie burn and down Glen Tilt crosses the 1750 contour-line, and that up Glen Tromie and down the Edendon water to Glen Garry ascends to 1700 feet—facts which make the choice of Glen Truim easily understood. Both the last two roads are in fact but little used save as means of access to the shooting-lodges in their respective valleys, and the railway when constructed naturally followed the existing highroad.

The reason why the road and rail cross the Spey just before reaching Newtonmore demands a moment's consideration. The crossing is determined first of all by the fact that the Spey is here relatively narrow, fairly rapid, and easily crossed, being bounded by considerable banks, especially on the southern side (cf. Figs. 1 and 2). Lower down, as for instance at Kingussie bridge, the banks are so low that even in summer it is not infrequent for the road to be flooded to the axles of conveyances. Once the river is crossed there is a long stretch of practically level ground. Here, it is true, the risk of flooding is considerable, and has occasioned some difficulty as regards the railway, while General Wade's original road avoided the low ground by a detour up the hill in the vicinity of Lynchat. The new portion of the road here is still occasionally liable to flooding in spite of the embankments,[1] but notwithstanding this fact the northern bank affords a much more convenient route than the southern.

Along this southern bank, however, there also runs a road which diverges from the main road at the point where the latter crosses Newtonmore Bridge, and is connected with it by roads crossing bridges over the Spey at Kingussie and Loch Insh. This road shows some interesting features which make it clear why the railway runs parallel with General Wade's road, in place of remaining on this side of the Spey. It will be recollected that the larger tributaries enter on the southern side, so that the road on this side has to cross the Tromie and the Feshie by considerable bridges, whereas on the other side there are nothing but insignificant streamlets. Further, we have already pointed out that the

[1] In the March floods of the present year parts of this road were covered by five feet of water.

Tromie and Feshie are rapid streams, while the Spey here is sluggish in the extreme. The effect is that where these two enter the main valley they throw down much of their load of material, and thus form well-marked alluvial cones as a result of the sudden check to their velocity. To avoid the swampy ground so formed, the road in each case before crossing the stream turns upwards, tracing out two sides of a triangle, and thus crosses the stream in each case at a point where it is rapid, and before it has been checked in its course. The road on this side of Spey is thus necessarily longer, more undulating, and less direct.

The only other road of any importance of which it is necessary to speak here is that which is continued westwards past Newtonmore, after the main road has crossed the river. Of this road one fork leads to Fort William, and forms the coach route to Loch Laggan and Tulloch on the West Highland Railway, this coach route forming thus a connection between the Highland and West Highland Railway systems. The road, as Mr. Hinxman points out in his article, crosses the watershed at a point which is only 848 feet above sea-level, but our interest in it here lies in the fact that at first sight it seems remarkable that, in view of the easiness of this route as compared with that over the Pass of Drumochter, Kingussie should not have been connected with the West Highland route rather than with the Highland. But it may be noted that, while the Highland Railway was opened so long ago as 1863, the West Highland was opened in 1894 only. Further, while the former is definitely commercial in its aims, the West Highland is in large part a tourist route. In brief, we may say that the railway connections of Kingussie are another illustration of the fact that throughout the greater part of Scotland the sources of wealth lie at the east and not at the western side, the Clyde estuary forming of course a marked exception.

The road which runs from Newtonmore to Fort William is joined before reaching Laggan Bridge by a road which connects with the main Perth to Inverness road at Dalwhinnie. This is a part of another of General Wade's roads, and one of some interest. Its other end diverges from the Fort William road at Laggan Bridge, and, following the upper waters of the Spey, crosses Corrieyairack and descends to Fort Augustus. This road crosses the 2500 contour-line, and, owing to its elevation, is only used as a drove road. Owing to the height which it reaches, it had to be carried over Corrieyairack in zigzags.

To sum up, then, the Kingussie district is traversed by the main road from Perth to Inverness and by the Highland Railway. The only other notable line of communication which it possesses is the road connecting it with Fort William, a part of which forms the coach route connecting the two railway systems of the Highlands. The remaining roads are mostly of minor importance.

Conclusion.

We have now noted the principal natural phenomena of the Kingussie district, and during the survey have indicated the conditions which determined first the economic arrest of the district, and subsequently

rendered possible a secondary development. In conclusion, some general points are worthy of notice.

In general terms we may say that the great rival of the Highlands as a "playground" is the country of Switzerland, the country which above all others has learned how to utilise its natural economic disadvantages as a means of attracting tourists. Between the Highlands and Switzerland there are many obvious differences which cannot be discussed here, but two present themselves as of interest in the present connection. In the first place, no visitor to the two regions can fail to be struck in the latter by the evidence of a vigorous peasant life behind the waxing and waning stream of tourists. The ubiquitous cow; the little patches of hay, so carefully husbanded; the numerous châlets, many with marked signs of prosperity about them, are obvious to the most casual visitor. Such a vigorous peasantry is at least not conspicuous in most parts of the Highlands, though in the Kingussie district, for example, the visitor will find many a trace of a former more extensive population.

The second point—and it is no doubt related to the first—is that as compared with Switzerland the Highlands are markedly deficient in roads. Every valley in the higher parts of Switzerland has not only its main road, but has radiating out from its tourist centres a number of side roads, which lead perhaps by passes over into the neighbouring valleys, but as often as not lead only to the "alps" or upper pastures, or to famous view-points. If we take the Kingussie district as a typical Highland district, we find that not only are the roads few in number, but that some of those existing are claimed as private, while over others traffic is what is called "discouraged" by the owners or lessees of the shooting-lodges in the summer season. Now there can be no reasonable doubt that the great popularity of Switzerland is due not only to the natural beauty of the scenery, but also to the innumerable roads, and to the genius which the Swiss display for road-making. As a result, over much of the country all the districts of special interest are readily accessible. The paucity of roads in the Highlands is partly to be explained by the history of the region, and partly by the much less rugged contour, which, by facilitating communication, renders a road of less importance than in a country of cliffs and precipices. While in the earlier days this absence of definite tracks was probably of little importance, its effect in recent years has been to cut off from the use of the public enormous areas of country, now used as grouse-moors or deer-forests.

The stages in the later development of the Highlands may indeed be given as follows. After the collapse of the rebellions of the eighteenth century they began to undergo an economic development. This development was, however, checked when the region began to be given over to sport and the formation of the large deer-forests took place. The monument of the old conditions is to be found in those ruined villages with which the hillsides are so freely sprinkled. But though in this, the first phase of the struggle, the sportsman was entirely triumphant, latterly a new competitor for the Highlands has appeared upon the scene—the general tourist. That his interests are antagonistic to those of the

owners of deer-forests and grouse-moors appears at least to be the opinion of the latter, if one may judge by the notice-boards with which those waste hillsides are so freely besprinkled. If it be said that with this conflict the geographer as such has no concern, the reply must be that, in so far as it is a matter which affects the efficiency of the nation as a whole, the geographer is directly concerned with it. If it be true, as it would seem meantime to be true, that the town-dwellers can only maintain their efficiency by a yearly contact with nature, then it would certainly seem desirable that the pleasure resorts of the nation should be maintained on a democratic basis.

Further, while large deer-forests and grouse-moors would seem to be wholly incompatible with an economic development of the area concerned, the example of Switzerland shows that this can go on side by side with a constantly increasing stream of tourists, and that with an adequate development of roads and tracks these tourists need not interfere with the ordinary operations of agriculture. If we further remember that the demand for deer-forests and grouse-moors is wholly artificial, and may at any moment fail—nay, might even now fail were it not kept up from the opposite side of the Atlantic, and that they add nothing to the natural wealth of the country, it would seem that the geographer may reasonably hope that the general tourist will more and more encroach upon ground which has hitherto been the preserve of the sportsman, and for this, if for no other reason, may wish continued prosperity to Kingussie and Speyside.

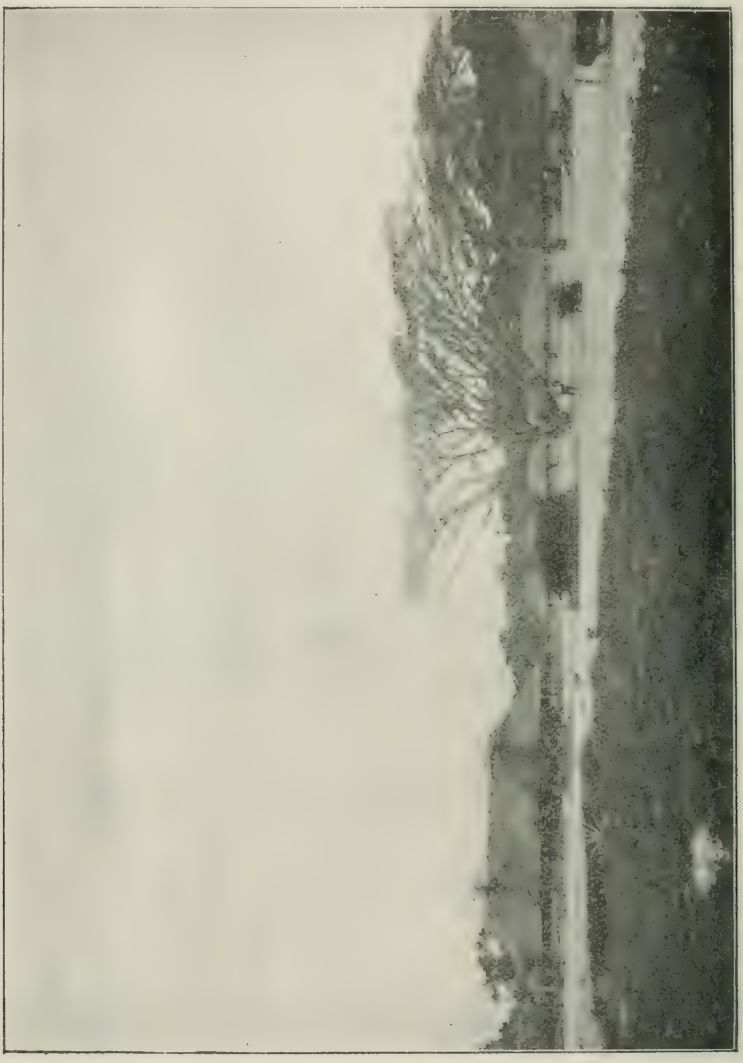
NOTE.—In the preparation of the above paper the author wishes to acknowledge great indebtedness to two papers by Dr. H. R. Mill in the *Geographical Journal*, that entitled "Proposed Geographical Description of the British Islands based on the Ordnance Survey" (April 1896), and "A Fragment of the Geography of England" (March and April 1900).

THE NORTH-EASTERN TERRITORIES OF THE CONGO FREE STATE.

IN a paper read before the Geological Society (cf. *Quarterly Journal*, vol. lxi. p. 641) M. Gaston Felix Joseph Preumont gives an account of an expedition to some of the north-eastern territories of the Congo Free State, which he carried out on behalf of the Government of the State as mining engineer and geologist. As his observations are of considerable interest, we summarise his paper here. In reading the article reference should be made to the series of maps of the Congo Free State which appeared in our April issue last year.

The region studied by M. Preumont was that of the Welle district and the Lado Enclave, which constitute the north-easternmost provinces of the Free State (see map of Political Divisions). They cover an area at least six times as large as Belgium, the Welle district alone extending over 72,000 square miles. On the map the district presents the

appearance of a long and broad belt of country nearly parallel to the Equator, stretching approximately from latitude 2° 30′ to 5° north, and from longitude 23° 30′ to 32° east of Greenwich. Eastward the region reaches as far as the Nile and adjoins there the Uganda Protectorate.



The Government Station at Bumba.

Northward it is bounded by the Egyptian province of Bahr-el-Ghazal, and further west is divided from the French Congo by the river Mbomu, which by joining the Welle river forms the Ubangi. On the south-west and south it is contiguous with other provinces of the Free State. The south-eastern extremity of the district reaches to Lake Albert.

From Boma on the Lower Congo, the capital of the State, access is obtained to the Welle district by the usual route to the interior—that is from Boma to Matadi by steamer, from Matadi by the line of rail which crosses the mountainous belt of the Sierra de Cristal the Upper Congo is reached at Stanley Pool. Here the steamer is again taken, and about eighteen days is sufficient for the journey on the river from Leopoldville to Bumba. Thence two or three days longer enable the traveller to reach Ibembo, the port of entrance of the Welle, which is placed on the River Itembiri, itself a direct tributary of the Congo.

Once within the Welle district the means of communication are much more primitive, and consist generally either in using native canoes for travelling over the rivers, which are often full of rapids, or of tramping overland along the native paths. Roads for wheeled traffic did not exist at the time of the survey, but are now being laid out. The work of exploration, and especially of geological surveying, is naturally difficult. In the Equatorial Forest the field of observation is limited to the narrow strip of the native footpath, and the traveller may go a day's march without meeting with any rocks *in situ*. In the vast plains to the north similar difficulties occur owing to the presence of the long grass through which it is often necessary to cut a road. Only for three months in the year after the grass has been burnt is this obstacle removed.

As regards the physical features of the district, it is to be noted that, as one (No. 2) of the maps referred to shows, a large part of the Welle district is densely wooded, forming part of the great Equatorial Forest which stretches as far as the Bomokandi and Welle rivers. North of these the country consists generally of vast plains covered with grass and scrub, traversed by wide valleys into which the forest sends prolongations from its main area, for the trees naturally follow the watercourses. The country reaches its greatest elevation towards the east, at the Nile-Congo watershed, where it attains an elevation of 3300 feet, and in places as much as 4000 feet. On the south-east a wide area is hilly and even mountainous. In the north-eastern part, close to the Bhar-el-Ghazal, there appears a group of hills of some importance, with Mount Bundukwa, Mount Yambili, and several smaller elevations.

Westward the country becomes gradually lower, and forms a series of broad undulations which produce hardly any visible effect on the contour. This monotonous country is pierced in places by groups of isolated hills, such as Mount Angba, on the Welle near Amadi; Mount Majema, near Poko; Mount Tena, on the Bomokandi; and others of minor importance.

Close to Libokwa a ridge of granite running north-west and south-east stretches quite close to the southern bank of the Welle, and extends towards the Falls of Lipodongu on the Rubi.

The Welle district is extremely well-watered. The Welle river arises in the mountains near Lake Albert, and traverses the district from east to west, throwing its network of tributaries northward and southward over a wide area representing more than 60,000 square miles. The southern tributaries are the most important—a fact easily accounted

for, since the southern zone is more densely wooded and has a heavier rainfall than the northern.

A rough parallelism is noticeable in the disposition of all the principal tributaries of the Welle; north of the river they almost all run nearly north-east and south-west, while those on the south side trend more west-north-westward and east-south-eastward.

Owing to the small slope of the rivers and streams the country becomes extremely swampy in the rainy season; small rivers of no importance at other times then expanding over enormous floodgrounds. This is especially noticeable in the northern zone, where the country is more level and the ground more argillaceous. The Welle, in common with most of its tributaries, generally winds its way through high banks of clayey alluvium, and runs through a broad basin much too shallow to be called a valley. The course of the stream is interrupted by numerous rapids, which divide it into reaches of quieter water, easily navigable by native canoes. In flood-time the Welle rises from twelve to fifteen feet, and its volume of water is increased at least fivefold.

That the slope of the river is not great may be illustrated by the stretch between Suronga and Niangara, where there is a difference of level of only 42·6 feet in a distance of a little over sixty-two miles.

M. Preumont's journey was in two parts, the object of the first part being Ndoruma, the northernmost station of the State in the Welle district. Starting from Ibembo he proceeded by the River Itembiri to Buta, and crossing here overland to the north, reached the Welle at Bima. From Bima the river Welle was closely followed, for the most part by the land route, to Niangara. Thence he proceeded across country in a northerly direction to Ndoruma, which was made the base for some time.

The second part of the journey included a visit to the country situated between Dongu and the neighbourhood of Mount Gaima, thence towards Farash and the Lado Enclave, through the central part of the Nile Territory to the Nile itself. Finally, returning from the Nile Territory, he traversed the mountainous portion of the Welle district, situated near Arebi, and later took a route more to the south in order to visit Mount Tena. The return to Buta was made by Poko, Zobia, and the Lipodongu Falls on the Rubi.

Starting from Ibembo to follow the Itembiri to Buta, the first rocks encountered were at the rapids of Go, where the river changes its name to Rubi. About this river were found a series of sedimentary rocks, chiefly shales, which continue up to Buta. About thirty miles north of Buta, however, between the Bali and Libokwa, a well-defined massive ridge of granite appears running in a north-westerly and south-easterly direction. The intervening country is made up of alluvium and clay in the depressions, while upon the slight eminences a limonitic pudding-stone is often met with. From Libokwa to Bima on the Welle the same granite and ferruginous rocks are also abundant. Thus, on entering the basin of the Welle, the main point to be noticed is its granitic substratum.

The relation between the levels of the basins of the Rubi and Welle

rivers is interesting. At Buta the basin of the Rubi is about 1600 feet above sea-level, while that of the Welle at Bima is about 2000 feet. Since the distance between the two places does not exceed fifty-five miles in a bee-line, the difference of level is somewhat remarkable. The separation of the two basins is well defined by the ridge of granite mentioned above.

The distance between Bima and Bomokandi is given as eighty-one miles by the waterway, the difference of level between the two places being about 82 feet. As the author travelled this distance in a canoe in the time of highest flood, little could be made out in regard to geology except to show that granite was everywhere present. The rapids were numerous and strong, and at each blocks and masses of granite were much in evidence. In places the grey argillaceous deposit which formed the surface layer was very like kaolin, and was used to whitewash the houses. Above this kaolinised surface deposit there appeared in some places a limonitic pudding-stone, of wide distribution in the district.

From Bomokandi to Amadi the distance overland is about fifty-five miles, but the Welle river follows a more circuitous course to the north, bending round in the shape of a great bow. The altitude of the Welle at Bomokandi is 2034 feet, and at Amadi 2240, so that there is a more considerable fall between these two places.

At a distance of about fifteen miles from Amadi the author came across an important group of hills, the principal being Mount Angba, situated on the right bank of the Welle. North of Mount Angba is Mount Lingwa, while southward across the Welle were seen Mount Manjana and other minor hills.

The height of Mount Angba is about 2867 feet above sea-level, the summit being nearly 650 feet above the level of the river. The eastern face is in its upper portion rather steep, as is the hill also on the south and south-west. North-westward the ground falls away more gradually, and northward extends towards Mount Lingwa in the shape of a long ridge.

The mountain is an enormous mass of iron ore, stretching for a couple of miles in length in a north-and-south direction, by about half a mile in width. Near the top immense beds of hæmatite are laid bare.

The three hills of Angba, Lingwa, Manjana, together with some others, form an ill-defined range, extending apparently in a southerly direction towards Poko. It is possible that the range is continuous as far as Poko, where another iron-ore mountain, Mount Majema, occurs. The iron ore of thes ehills appears to be of the same type as that found in Mounts Gaima and Tena.

Past Suronga, which has a height of about 3260 feet, granite seems to give way to metamorphic rocks, which are also found towards Niangara. North of Niangara the country is flat, devoid of hills and but slightly undulating. The slight differences of level may be realised from the following figures: Niangara, 2360 feet; Bafuka, 2460 feet; Ndoruma, 2500 feet; Yakuluku camp, 2430 feet. The three last-mentioned form almost the apex of the watershed between the Nile and

Congo basins. There is, however, no definite ridge here, but merely a monotonous plain or level plateau, where the many tributaries of both streams intermingle their springs and courses into an inextricable network. In the dry season, here well-defined, the country is in this part so parched and dry as to be waterless over large tracts; while in the rainy part of the year it becomes extremely marshy on account of the predominantly argillaceous character of the subsoil, and the watercourses, having only a slight fall, then expand into enormous swamps. In this zone clay appears to constitute most of the subsoil, but is frequently overlain in its higher parts by limonitic rocks. Towards Tambura, to the north of Ndoruma, the country becomes hilly again, and the watershed is more distinctly defined by outcrops of gneiss.

Travelling eastward from Ndoruma, a little to the south of the border, the party reached a knot of hills situated near longitude 29° 10′ east, and latitude 4 23′ north, comprising Mount Baginse in the Bahr-el-Ghazal, and Mounts Bundukwa, Nangano, and Yambili on the Congo side of the frontier. Between Ndoruma and this point the intervening country presents no hills, only large undulations, forming the shallow valleys of the tributaries of the Welle. Clay and limonitic pudding-stone were here the only rocks met with as far as Yakululu. Some twelve miles east of that place appears the group of the Bundukwa Hills, a possible remnant of what may have been once a mountain-chain ranging north-west and south-east, and perhaps connected with hills of a similar nature situated in the Nile Territory. Looking eastward from the top of these hills, the country is seen to resume its monotonous aspect of a level plain without noticeable elevations.

Mount Bundukwa (3225 feet) is about a mile and a half in length in a north-westerly and south-easterly direction, by about half a mile in width. Its elevation above the neighbouring plain is nearly 600 feet. The surrounding plains are thickly clothed with undergrowth of bush and scrub, but the hill itself, like most granitic peaks, is bare of vegetation. The rocks are strongly folded gneiss. Mount Yambili, situated about 2½ miles east of Bundukwa, has identically the same formation. The plains surrounding the hills are mostly built up of alluvium, with here and there small rocky outcrops of the same nature as those observed in the hills.

Very different is Mount Tena, which rises to a height of 4900 feet above sea-level and forms a prominent feature in the landscape. It is formed of a great mass of iron ore, and has at its base on the south and west an exposure of limonitic conglomerate. This conglomerate, as mentioned above, is of wide distribution throughout the Welle district. Its thickness nowhere exceeds 30 feet, and in most places is only about 6 to 10 feet. It is most abundant on the lower elevations, especially below the Mount Angba hills and Mount Tena. The author suggests that it owes its origin to the denudation and erosion of the iron ores of the mountains, or even of other iron-bearing veins at present covered up. "The work of redeposition took place at a time when the Welle basin may have been more or less a succession of shallow lakes and vast

swamps. Then the alteration and redistribution of the ferruginous materials would have been attended by every condition favourable to the formation of such limonitic deposits. After being deposited over extensive tracts of country, the limonitic deposit has been removed by erosion along some of the watercourses, and this accounts for the formation being invariably found upon the summit of the gentle undulations. The process of formation of these conglomerates is not yet at an end, and in close proximity to the iron mountains it is still in operation." Practically, these deposits are of use in that they constitute admirable material for the construction of roads. Similar deposits are found in many parts of Africa.

The south-eastern portion of the district comprised between the Welle-Kibali and Bomokandi rivers forms a hilly and even a mountainous country with Arebi for a centre, averaging 3000 feet in altitude. At the headwaters of the Welle-Kibali, near Lake Albert and the Nile Territories, the ground is still higher, and probably exceeds 3600 feet in average altitude. This hilly zone appears to be entirely granitic in nature. To the north, near Vankerckhovenville and on the Welle-Kibali, Mounts Gaima and Yagu present some points of interest in their close analogy of structure with Mount Tena, iron-ore beds being much in evidence. Mount Gaima is 3960, and Mount Yagu 4400 feet above sea-level. From the latter the natives procure iron for making knives, etc., choosing spots where the ore is softer than elsewhere, and brittle. The hill-slopes are dotted with the pits made in their primitive attempts at mining.

In the Nile Territory (Lado Enclave) the rocks are all more or less metamorphic, but the country shows peaks of granite (such as Mount Loka, the Dinkala Hills, and Kojokaji) piercing through the stratified series of gneiss, quartzites, and mica-schists.

The main features in regard to the geology of the Welle district may be summed up as follows. The whole district, save for the small area forming the Rubi basin, where the rocks are of more recent origin, consists entirely of an area covered by the very shallow and broad basin of the Welle and its tributaries. This long belt is of great geological uniformity, and its whole substratum appears to be granitic and metamorphic. The country lying to the north of the Welle offers to view only limonitic and alluvial deposits, but the probabilities are that it is underlain by metamorphic rocks. Recent eruptive rocks appear to be very rare throughout the region, and fossils, as in Equatorial Africa in general, have not yet been found. The great part of this portion of the Congo basin has thus been above sea-level for a very prolonged period.

THE SOUTHERN HIGHLANDS FROM DUMGOYN.

By John Frew, M.A., and Frederick Mort, M.A., B.Sc., F.G.S.

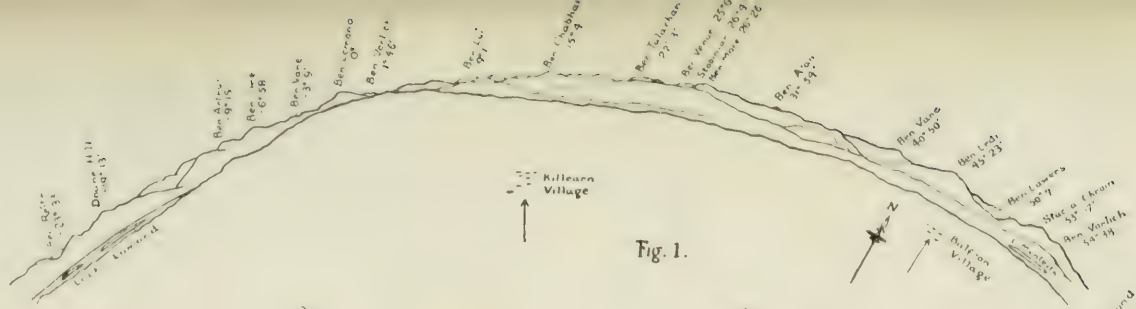
(With Figures.)

A good view of the Southern Highlands may be had from almost any elevated position to the west of Glasgow. It adds considerably to the interest of the view if the outstanding peaks can be recognised, and it is a matter of regret that very few can identify mountains the names of which are as familiar to them as their own. In excursions of scientific societies, when a favourable view of the Highlands has been obtained, we have invariably found that differences of opinion have arisen regarding even peaks with a marked individuality. An outline drawn from careful measurements is all that is needed for most purposes of identification, and on being informed that nothing of the kind had been published by the Royal Scottish Geographical Society, we have attempted to make good the deficiency.

Dumgoyn (1401 feet), a steep isolated hill of volcanic agglomerate near the western termination of the Campsie Fells, was chosen as a suitable spot from which to make our measurements. In several respects it is superior to any other place in the northern Clyde valley. It is far enough west to be clear of both Kilpatrick Hills and Campsie Fells. It is not near enough the Highland line for the view to be confused, as is the case to an observer in the Highlands, who is apt to be perplexed by the sea of peaks around him. Lastly, its position can be easily fixed on the map. The angles were taken by means of a theodolite, both vertical and horizontal readings being noted. These angles were then accurately transferred to maps of the district. The actual contours of the hills were drawn from a series of sketches and photographs made on the spot.

Fig. 1 shows the frontier Highland peaks from Ben Reith (behind Glen Luss) to Ben Vorlich in Perthshire in their true angular relations, but on a comparatively small scale. Figs. 2, 3, and 4 show the same peaks as Fig. 1, but in order to make identification easier, the horizon has been straightened and the scale enlarged to about three times the former size. The height of the prominent crests is given in feet. It is obvious that the apparent height of a mountain does not necessarily agree with the real height, the distance from the eye being an important factor.

As Ben Lomond is the summit most easily recognised, the angles were measured from it. Angles to the right of it in Fig. 1 are considered positive, and those to the left negative. Several of the hills have a distinct individuality that makes identification easy. Ben Venue has a doubly peaked summit, the height of the eastern spur being only 7 feet less than that of the western. Ben Ledi appears the most massive mountain, its nearness giving it a conspicuousness to which it is not entitled by its actual height. Ben Vane ($+40^\circ\ 50'$) is distinctly flat-



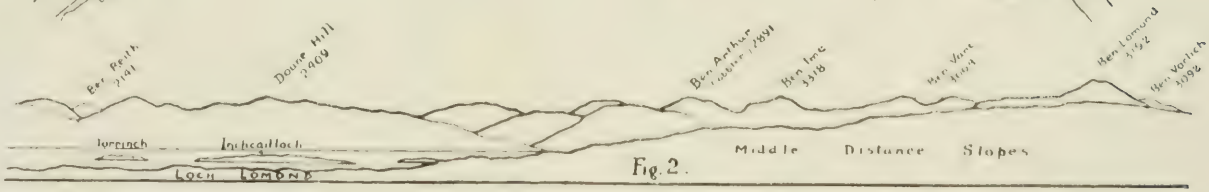


Fig. 2.

Fig. 3

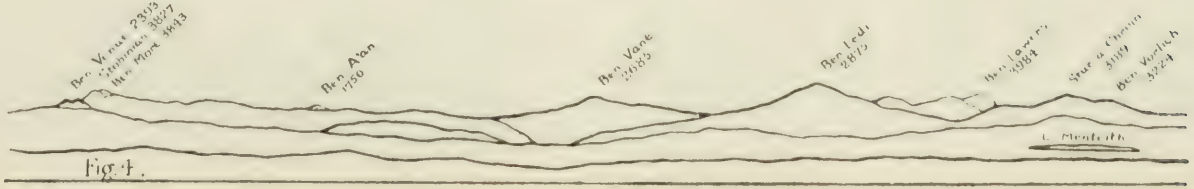


Fig. 4.

topped. The summit of Ben A'an can just be detected peeping over an intervening ridge. Ben Vorlich (+1° 46′) has almost the appearance of being a shoulder of Ben Lomond. Ben More and Stobinian look like one peak, but a field-glass separates them quite distinctly.

From an elevated position within the Highland area, at a first glance there is revealed on all sides a bewildering chaos of mountain and valley. There seems to be no order, no arrangement, no underlying causal principle in this tumbled sea of hills. A closer examination, however, shows that the mountains as a whole reach a fairly uniform height. If the material carved out of the valleys by river erosion were replaced, we should see an almost level tableland. This can be particularly well seen from a point outside the Highlands, such as the one from which the accompanying drawings were made.

This tableland, however, has not been the result of the elevation of almost horizontal beds such as we find so well displayed in the United States. The structural planes of the rocks strike the surface at all angles. It is undoubtedly a base-level of erosion, which at a later time has been raised comparatively slightly and then carved into its present appearance by atmospheric agencies.

It should be noted, finally, that the drawings show the peaks that are visible on a fairly clear day. Mountains like Ben Lawers, Ben More, or Ben Lui are so far away that a slight haze could easily obscure them.

GEOGRAPHICAL NOTES.

Europe.

The Eruption of Vesuvius.—Dr. Hj. Sjögren gives in *Nature* a short account of an ascent of the cone of Vesuvius which he made on April 23, this being one of the first ascents after the late eruption. His account throws some light on the phenomena of the eruption. No special difficulty was encountered during the ascent, but care had to be taken to avoid the courses of the avalanches of stones and ashes which spread over the slopes more than half a mile from the foot of the cone. He estimates the new crater formed by the eruption to have a diameter of about 3000 feet. The bottom was not visible, but the walls could be made out down to a depth of about 1000 feet. The inner walls are nearly perpendicular, or even overhanging, and the crater at the time of his visit was still being enlarged by the falling in of parts of the walls. The height of the crater edge is now greatest to the west, and diminishes by irregular steps to the north and east, this alteration in shape probably accounting for the direction taken by the showers of lapilli and ashes which destroyed the villages of Ottajano and San Giuseppe. The present crater corresponds closely to the descriptions of the great crater formed in 1822.

Although the earlier accounts of the eruption laid considerable stress upon the outflow of lava, Dr. Sjögren gives it as his opinion that the

total quantity was comparatively small, and that none of it came from the crater. He does not mention the stream of March 28, which was one of the first signs of marked activity on the part of the volcano, and poured out from a fissure situated some hundred yards from the upper station of the funicular railway, but states that the other streams came from the foot of the cone. The first lava-stream mentioned by him is that of April 4, which reached the surface a little west of Casa Firenze and soon stopped. Another stream he states started from Casa Firenze, destroying the buildings there, and flowed towards Bosco-Trecase. The lava which partly destroyed the last-named village started lower down the slope, and divided into two parallel branches. On the whole, the distinguishing feature of the eruption seems to have been the large amount of lapilli, dust, ashes, etc., which has been thrown out, and this recalls the historic eruption of 79 A.D.

Asia.

American Expedition to Turkestan.—Mr. Ellsworth Huntington returned to London at the end of April on his way back from his expedition to Chinese Turkestan. The first part of his work was described here (p. 100) previously, and the expedition concluded with an examination of the Lop Nor region. On approaching this lake the party travelled for four days over a great salt plain, evidently the site of an old lake bed, which was covered with hard deposits of salt. This was followed by a journey over an older lake floor, red in colour, and glistening with crystals of gypsum. The whole country was absolutely desert, and was exceedingly cold, the temperature dropping at night several degrees below zero Fahrenheit, more than forty degrees of frost being registered. From Lop Nor the party proceeded by a new route across the Kuruk Tagh mountains to Karashar, from which place a visit was made to the Turfan depression.

Dr. Sven Hedin's Expedition.—This explorer has accomplished the first part of his journey in safety, for, according to a note in the *Times*, he reached Sistan in the early part of April. His journey thither has been successful and interesting, for he had crossed the Dashtikavir three times, and has collected material for a great work on Eastern Persia. He has also made a map of 162 sheets, has taken hundreds of photographs and sketches, and has formed a collection of rocks. When the message left, Dr. Sven Hedin was on the point of leaving for Nushki (cf. this *Magazine*, p. 101).

Africa.

Map of Lake Chad.—In *La Géographie* for March 15 there appears a general map of Lake Chad, on the scale of 1 to 400,000, drawn by Captain Jean Tilho (cf. this *Magazine*, p. 102), and accompanied by a general article describing the surveys upon which the map is based. In Captain Tilho's opinion the "lake" is now nothing but "an immense

pestilential marsh—as it were the putrifying corpse of a lake." It is, however, possible that the level has always tended to fluctuate, and that there may yet be a positive variation.

The Spanish Colonies in the Gulf of Guinea.—With the loss of so many of her colonies of recent years, the attention of Spain has been more and more drawn to those which remain, some of which are still quite undeveloped. It will be recollected that the limits of the territory of the Muni, in the Gulf of Guinea, were fixed by the treaty of June 27, 1900, with France, and this Spanish colony occupies a stretch of land between the estuaries of the Campo and the Muni on the mainland, and also includes the two islands of Elobey and that of Corisco. Spain's other possessions in the Gulf of Guinea comprise the islands of Fernando Po and of Annabon. This group of colonies forms the subject of an important article in a recent issue of *Questions Diplomatiques et Coloniales* (No. 215), of which the following is an abstract.

Annabon is a small island of lava, whose mountains rise to a thousand metres, and are sprinkled with volcanic lakes. It is almost entirely covered with forest, but the lower slopes are cultivated to some extent. The inhabitants, almost exclusively coloured, do not reach 1400 in number.

Much more important is Fernando Po, with its area of 2100 kilometres and its population of over 20,000. It is composed of two great volcanic masses, of which the higher (Santa Isabel or Clarence Peak) rises to 2850 metres. The rainfall is high, and where it has been measured on the littoral rises to 2 m.60 or 3 metres, but there can be no doubt that this figure is exceeded on the heights. At Santa Isabel, the capital, the temperature fluctuates about 27° C., not dropping at nights and varying but little throughout the year. On the other hand, at a height of 1400 metres it is only 15° by day, dropping to 9° or even to 3° at night. The slopes thus offer excellent conditions for the establishment of sanatoria for Europeans, were it not for the difficulty of access due to the forests and to the fields of lava. There is abundance of water-power, and the lower grounds are very fertile, though unhealthy. The chief product is cocoa, but as yet the resources of the island are almost wholly undeveloped.

The Rio Muni territory, which has a total length of 120 kilometres, is densely clothed with forest, which approaches very near to the shore. The rivers are bordered by barriers of swamp plants, ports are few, and access to the interior is fraught with many difficulties. It would appear, however, that the Muni estuary is well adapted to become an important port. The rainfall in the territory is heavy, the temperature is almost constantly 23°, and the trees give off such a damp heat that the sky is permanently obscured with vapour. To the interior the forest thins out, but the crossing of the tree belt offers almost insuperable obstacles to Europeans. The total area of the continental portion of the colony is 26,000 square kilometres, and the estimated population 140,000, which gives a density of 6. The forest is rich in valuable products, but the first essential is the establishment of healthy stations

where Europeans may live, and in this connection the possibility of establishing sanatoria on Fernando Po is of great importance. Meantime the percentage of sick among the European soldiers introduced into the colony is very high. It will thus be seen that the development of these Spanish colonies is not a very simple matter.

America.

The San Francisco Earthquake.—An article in *Nature* for April 26 gives some interesting notes on the earthquake of April 18. It is remarkable that the first and greatest shock of the earthquake was heralded by no warning tremors or earth-sounds. It occurred at 5.13 A.M. (1.13 P.M. Greenwich mean time), and lasted for two or three minutes. It was this shock which produced the most destruction, but it was followed by other considerable shocks throughout the morning. The destructive fires which followed, and were responsible for most of the ruin caused, seem to have been largely due to the short-circuiting at many points of the electric current, which was unfortunately not turned off at the power stations. The fires were, of course, assisted by the fact that no water was available, owing to the injury to the mains.

As yet the extent of the area disturbed by the earthquake has not been ascertained, but Dr. C. Davison, the author of the article mentioned above, is of opinion that the epicentre was submarine, and situated some little distance from the coast. It seems probable that to the west of California, below the surface of the ocean, there lies an embryonic range of mountains, "of which the San Francisco and other earthquakes are the birth-throes."

As to the magnitude of the earthquake, it certainly belongs to the front rank, and Dr. Davison gives it as his opinion that it will probably be found to rank with the Neapolitan earthquake of 1857, the Japanese one of 1891, and the Indian one of 1905.

Exploration of Labrador.—In vol. xxi. p. 496, a Note was given on an expedition to the Coast of Labrador carried out last summer by Sir William Macgregor, the Governor of Newfoundland. The Report of this expedition has recently reached us, and details the various observations made. It will be recollected that a feature of the expedition as planned was the taking of astronomical observations to determine geographical positions. The report states that a considerable number of these were taken, in spite of the meteorological difficulties experienced, but they have not yet been finally calculated, as the Canadian positions are undergoing a process of revision which was incomplete at the time of the issue of the report. Much attention was given to meteorology, and there are a number of tables appended to the report, containing temperature observations made by the Moravian missionaries at six stations established by the *Deutsche Seewarte*. The body of the report contains a number of interesting notes on the natives of the different stations visited, as well as observations on the plants and rocks of the region. It does not appear that the hope of discovering valuable mineral

deposits was realised, for those noted do not seem capable of commercial development. The fisheries are apparently valuable and are likely to undergo further development. In 1905 the total exports from Labrador were roughly 3,000,000 dollars, and of this total dried cod-fish accounted for no less than 2,938,448 dollars. But as fuel is very scarce and the forests scanty, especially in the north, which is practically destitute of fuel of any kind, the future of the fisheries, according to Sir William Macgregor, depends upon the proper conservation of the existing forests. Forest fires have caused great havoc, and to save the woods that remain, a thorough investigation of the conditions appears to be necessary, and some means of applying the existing laws against firing the woods.

Sink-hole Lakes in Florida.—In a paper read by Mr. G. H. Sellards before the American Association for the advancement of Science (see *Science*, February 23), an interesting account is given of certain peculiar lakes in the peninsula of Florida. The region is very flat, and consists of a porous limestone overlaid by sand. In consequence, very little of the rainfall passes off as surface water, most penetrating straight into the ground. The solvent action of the water is indicated by the numerous sink-holes of the region, most of which are small, while some reach a considerable size. Where surface clay is absent in limestone regions, such sinks tend to remain open and serve as underground entrances for streams, but where clay is present they tend to become clogged up and fill with water. Such clogged sinks, if of any size, may rank as small lakes. One is described which reaches a size of more than one acre. The banks are thickly clothed with the hardwood or "hammock" types of vegetation, and while steep on one side, are sloping on the other.

A Blazing Beach.—An interesting phenomenon is recorded from Kittery Point, Maine. In the early part of September last year, the visitors at a hotel at this Point were startled by the sudden appearance of flames from the surface of the beach and of the water. The flames were about a foot in height, and were accompanied by a loud crackling noise, and by the evolution of sulphurous gases, which gave rise to some inconvenience to the inhabitants. The conflagration lasted about forty-five minutes, and occurred in the evening. The local papers gave various more or less fantastic explanations of the phenomenon, but beyond the facts stated above, the only investigation made at the time was that some of the sand in the locality was shown, when stirred in water, to give rise to bubbles of gas, which burst into flame as they were liberated at the surface. Subsequently the beach was investigated by Professor Penhallow of M'Gill University, who gives (*Science*, Dec. 15) a very simple and satisfactory explanation.

Professor Penhallow finds that the flames were limited to an area of the beach covered by sand, and that while they were observed over that part of the sand which was uncovered by the falling tide, they also extended over the shallow water for a distance of thirty to forty feet. This area of shallow water lies over a sandy bottom, and, like an extensive region further seawards, carries an abundant growth of eel-grass

(*Zostera*). Fragments of Zostera, mingled with organic débris of all kinds, are constantly being cast up, and mingled with the sand. The superficial layer of this, to the depth of about one inch, is composed of freshly washed sand, mingled with fragments of vegetation, etc., but below this the next six inches is so loaded with organic matter as to be perfectly black. It is clear that it is in this layer that the inflammable gases are produced, and they probably consist of sulphuretted hydrogen, marsh gas, and possibly phosphuretted hydrogen. The last two are well known to ignite spontaneously over marsh lands, producing "will-o'-the-wisp," and they doubtless in their turn ignited the sulphuretted hydrogen which was apparently so conspicuous a feature of the fire. Thus the blaze, for which some of the inhabitants sought a supernatural explanation, is seen to have had a very simple origin. Professor Penhallow suggests that some forest fires may originate in a similar fashion.

Polar.

Mikkelsen's Arctic Expedition.—This expedition, of which we have already given various notices (xxi. p. 608, xxii. p. 105), sailed from Victoria, Vancouver Island, on May 20, and has been named the Anglo-American Polar Expedition, in recognition of the liberal support given to it both in England and the United States. The final plans are given in an article in the *Times*, under date April 21, of which an abstract follows :—

Mr. Mikkelsen has been able to purchase a schooner of sixty-six tons burden, which he has named the *Duchess of Bedford*, after one of the patrons of the expedition. This vessel was at one time engaged in the sealing trade, and, though small, is very strongly built. She is sheathed with gumwood from 2 feet above to 3 feet below the water-line, and the bow is also protected with iron plates. There is accommodation for seven men aft and four forward. On leaving Victoria, the expedition will first proceed to Kadiak Island, off the south coast of Alaska, and after a short stay will cross over to the Asiatic side, and cruise along the coast of Eastern Siberia, purchasing dogs at the various Eskimo settlements. A Siberian pony will also form part of the equipment. It is hoped to complete this work and enter Behring Strait by the beginning of August. The schooner draws only 8 feet of water, and her small draught is relied on to enable the expedition to pass through the shoals bordering the coast, thus avoiding the heavy pack ice. Special attention will be devoted to the flow of the tides, particularly between Harrison Bay and Herschel Island. If possible, landings will be effected at two or three points on the coast, and a few days spent at each place in recording observations.

It is hoped that the mouth of the Mackenzie River may be reached by the third week of August. Here the scientific party, which is to include Mr. Stefansson, ethnologist, in addition to those previously mentioned, will await the arrival of the ship. The united party, ten in number, will then continue the voyage eastwards past Cape Bathurst

before turning north and seeking a passage to Prince of Wales Strait, the channel separating Banks Land from Prince Albert Land. The intention is to establish a depôt on Banks Land abreast of Princess Royal Island, which is situated about half-way through the strait. Then the expedition will seek winter quarters in Minto Inlet, which penetrates the south-western corner of Prince Albert Land. With the return of spring, exploring trips will be undertaken in various directions. The main piece of work will be attempted by Mr. Mikkelsen with one companion. Using the depôt established in the previous autumn as their base, the explorers will seek to make their way first to Melville Island, and thence to Prince Patrick Island. From the north-west corner of Prince Patrick Island they will start out over the ice in a NNW. direction. It is not proposed on this occasion to attempt a longer march than 60 miles, and the return journey will probably be commenced after a still shorter march, should the edge of the continental shelf be reached at a point less than 60 miles from the shore. Mr. Mikkelsen hopes to be back at the winter quarters again by the beginning of June, and as soon as the ice opens sufficiently to allow the *Duchess of Bedford* to leave Minto Inlet the vessel's course will be directed to the west coast of Banks Land, where a new station will be established in Burnet Bay. It is from this point that the journey which originally formed the main objective of the expedition will be undertaken, in the spring of 1908. Mr. Mikkelsen, with two companions, proposes to set out over the ice in a true WNW. direction. For transport purposes they will have the dogs and the Siberian pony, and, in addition to kayaks, sounding apparatus, and various scientific instruments, they hope to carry provisions for 140 days. It is not improbable that land will be discovered in the course of the march, and in any case useful records of the dip of the continental shelf should be secured. If neither land has been discovered nor the edge of the continental shelf reached by the time the explorers have travelled as far as latitude 76° 30′ N., longitude 150° W., the course of the journey will be altered. If the conditions are favourable, Mr. Mikkelsen is anxious to strike south-westwards towards Wrangel Island. It is so uncertain where the journey will end that no attempt is likely to be made to arrange a rendezvous with the other members of the expedition. Mr. Mikkelsen and his two companions trust to securing a passage back to civilisation on board an American whaler, while the vessel will return independently either in the autumn of 1907 or the summer of 1908.

The Wellman Polar Expedition.—The American project of attempting to reach the North Pole in an air-ship is now well under way. In the *National Geographic Magazine* for April the leader, Mr. Walter Wellman, gives a very full account of the dirigible motor-balloon in which the attempt is to be made. This is being constructed in Paris, and is to contain two gasoline motors of 50 and 25 h.p. respectively. The average speed is expected to be twelve geographical miles per hour. A start is to be made from Spitzbergen for the Pole at the end of next July or the beginning of August. The journey to

the Pole and back to Spitzbergen is expected to occupy something like ten days, but some of Mr. Wellman's calculations give forty hours or less as the time required to reach the Pole. In any case it is obvious that, even if the expedition prove successful as to its immediate aim, it is not likely to greatly advance geographical knowledge.

Prince of Monaco's Third Arctic Expedition.—The Prince of Monaco leaves on the 20th June for Spitzbergen with his scientific yacht *Princesse Alice*. The expedition will carry on general oceanographical research in seas adjacent to Spitzbergen. One of the features of the expedition will be balloon work in order to get a knowledge of the meteorological conditions in the upper atmosphere. Last year the Prince made extensive experiments in this direction in the NE. Trade Wind region; he now feels it important to take observations in high northern latitudes. The Prince also intends to land one or more parties to cross and explore the interior of Spitzbergen. Mr. W. S. Bruce of the *Scotia* accompanies the expedition. These observations, along with Mr. R. C. Mossman's on board the *Scotia*, now cruising in Greenland Seas, cannot fail to add materially to our knowledge of the meteorology of the North Polar Regions.

General.

Precipitation and Mountain Form.—In the *Abrégé du Bulletin de la Société Hongroise de Géographie* for 1903, which has only recently reached us, there appears an interesting article by Dr. Eugen v. Cholnoky on the effects produced on mountain chains by the differences in the distribution of precipitation on their slopes. It is of course a commonplace of physical geography that when a chain of mountains lies in the course of moisture-carrying winds there is copious precipitation on the slopes which face the wind, and that the consequence, where the rain-bearing winds come from one direction only, may be to produce arid conditions in the region lying at the opposite side of the mountains. But the effect of precipitation on the actual forms of mountains is less frequently discussed, and it is this which Dr. Cholnoky considers. After an interesting survey of the chief ranges of the globe, he sums up by saying that where the direction of the chain is such that precipitation is approximately equal on the two sides, the result is, in the general case, that erosion is equal on the two sides, and therefore the water-parting tends to run along the crest of the range. This condition, well exemplified in the Pyrenees, is very unfavourable to traffic across the chain. On the other hand, where the precipitation is markedly unequal on the two sides, the side with the greater rainfall is eroded much more rapidly than the other, and the result is that the water-parting is always being shifted back towards the side with lower rainfall. The effect is to facilitate communication by the cutting of deep ravines. Various interesting examples of these conditions are discussed, one being the apparent perforation of the Transylvanian Alps by certain of the tributaries of the Danube. Reference to the map will show that the river Aluta, for

example, which rises in the basin of Transylvania, has excavated a course for itself through the mountains, and reaches the lower ground of Roumania through the Rother Thurm Pass. On a smaller scale the same phenomenon is repeated by other streams. The explanation suggested is as follows. Originally the Aluta and its companion streams were represented by rivers which drained only the southern and south-east slopes of the Transylvanian Alps. On the other side of the range there is much limestone in the interior, and the circulation of water at this side must have been at least largely underground, and it is assumed that there would be a tendency for this underground water to drain towards the Roumanian side. The rainfall on that side is considerably greater than on the Transylvanian side, and for the reasons already explained this would lead to a constant shifting of the water-parting backwards. The shifting in this case would be greatly assisted by the occurrence of underground cavities in the limestone, and would ultimately lead to the apparent perforation of the chain which is now so remarkable a feature of the region. It is possible that the passage of the Danube through the Iron Gates is capable of a similar explanation.

New Oceanographic Institute and Museum.—According to a *Times* correspondent the Prince of Monaco formally announced to the French Minister of Education on April 30 his decision to establish in Paris the Oceanographic Institute that he has founded. He will endow the Institute with the magnificent museum now existing at Monaco, including its laboratories, collections, aquaria, etc. The Prince has set apart 4,000,000 f. (£160,000) for the maintenance of the Institute. It will be established on grounds recently bought by the University of Paris with the assistance of the Prince in the Rue Saint-Jacques and the Rue d'Ulm. The scientific direction of the Institute is vested in an international committee of specialists in oceanography. The French Government has expressed its formal thanks for this really princely gift.

An Oceanographical Museum has also been established at Berlin in connection with the *Institut für Meereskunde*. The formal opening took place on March 5, in the presence of the Emperor and the Prince of Monaco, just five months after the death of Baron von Richthofen, to whose initiative the new Museum owes its origin. The museum is divided into four sections:—(1) a collection illustrating the Imperial Navy, containing pictures and models of warships, and specimens of guns, torpedoes, etc.; (2) a popular and historical collection illustrating the progress of navigation, with models of modern and primitive vessels, life-saving apparatus, and so forth; (3) a collection of instruments, etc., used in the study of the ocean and its contents, with numerous models showing the height of the continents and the depth of the ocean, the weight and volume of land and sea respectively in relation to those of the whole earth, the amount of salt in the sea, and so forth; (4) a collection illustrating the biology of the ocean and the fisheries, with examples of the products of economic value.

Oceanographical Research.—Dr. J. M. Flint, in Bulletin 55 of the *United States National Museum*, gives an account of some important

oceanographical work in the North Pacific carried out by the United States ship *Nero*. Starting from Honolulu the vessel steamed in a nearly straight line to Midway Island, thence to Guam, from Guam to Luzon, and from Luzon to Japan, sounding and taking temperatures, etc., as she went. The most interesting results were those obtained between Guam and Midway Islands. About half-way between the two a plain more than 3000 fathoms from the surface is interrupted by what is apparently a range of mountains, extending over three degrees of longitude, and rising in places to 720 fathoms from the surface. From the western limit of the plain, some three hundred miles from this mountain range, the contour is quite irregular till Guam is reached. Extensive detours to north and south of the direct course showed a mountainous region, with peaks rising to 689 fathoms below sea-level, and valleys descending to a depth of more than 5000 fathoms. Four soundings below 5000 fathoms were obtained, the figures being 5070, 5101, 5160, and 5269. This last is the deepest sounding on record, being only 66 feet less than 6 statute miles. The region has been named the "Nero Deep," and the deepest sounding lies in lat. 12° 43′ 15″ N., and long. 145° 49′ E.

Another important result was the finding of diatom ooze as a bottom deposit in tropical waters. Along a line of about 300 miles in length, lat. 14° 28′ to 14° 50′ N., and long. 136 to 130 30′ E., diatom ooze was brought up at thirteen stations from depths between 2432 and 3547 fathoms. In all the specimens examined the diatoms belong almost exclusively to a single species, identified as *Coscinodiscus rex*, Wallich.

Scottish Oceanographical Exhibits at Marseilles.—In the Colonial Exhibition at Marseilles is a special International Oceanographical Exhibit in a handsome though simple building called the *Palais de la Mer*. In this building France, Monaco, Holland, Belgium, Portugal, Germany, and Great Britain are represented. The organisation and arrangement of the British Section is mainly due to Dr. G. Herbert Fowler, the energetic Secretary of the British Section. Mr. J. Y. Buchanan, Captain Wilson-Barker, and others, have also specially interested themselves in the project. One striking feature is the strongly Scottish character of the exhibit. The Scottish Fishery Board, the Scottish National Antarctic Expedition, the Scottish Oceanographical Laboratory, and the West of Scotland Marine Biological Association are all represented. The Admiralty have made an interesting exhibit of *Challenger* gear—an expedition especially associated with Scotland. Mr. J. Y. Buchanan and Dr. H. R. Mill are among the Scottish exhibitors. The Royal Geographical Society of London have an exhibit which is preponderatingly Scottish by the inclusion of the detailed survey of Scottish Lochs carried on under the direction of Sir John Murray and Mr. Lawrence Pullar. The maps are made by Messrs. John Bartholomew and Co., Edinburgh.

A special feature in the exhibition is a series of exhibits of the recent French, German, Belgian, British, and Scottish Antarctic Expeditions. The handsome model of the *Discovery* and about three dozen

good photographs, and a few of Dr. Wilson's excellent water-colour paintings are exhibited by the Royal Geographical Society of London. The British Museum also show specimens of adult and young emperor penguins and some petrels. The *Scotia* exhibit is a large one, there being about three hundred very fine photographs of Antarctic scenery and animals, by which the narrative of the expedition is excellently told. Besides this are numerous maps illustrating the bathymetrical, topographical, and other work done by the Scottish Expedition in the South Orkneys, at Coats Land, and in the Weddell Sea. Some striking diagrams also demonstrate the important meteorological work done by the expedition. Not of least interest is a case with a well-stuffed young Weddell Seal, and also casts of the skulls of all the Antarctic seals.

A specially valuable and unique series of animals dredged up by the *Scotia* in Antarctic Seas in depths up to 2600 fathoms is also shown.

NEW BOOKS.

EUROPE.

Mittelmeerbilder. Von Dr. Theobald Fischer, Professor of Geography in Marburg University. Leipzig and Berlin: B. G. Teubner, 1906. *Price* 6 *marks.*

Professor Fischer gives us in this volume numerous well-written articles on various places connected with the Mediterranean, the result of thirty-three years' study of that region. Several have already appeared in German journals, such as his article of 1875 on the "Sicilian Question"; but he observes, in a foot-note, that there is still a "Sicilian question" unanswered by the Italian authorities. He gives an amusing account of the aristocracy of Sicily, an island as prolific in nobles as it is in vegetation, there being in Sicily, according to a list he saw, no fewer than 120 princes, 82 dukes, 124 marquesses, 28 counts, 356 barons, and a perfect swarm of scions all claiming to be of noble birth. This is pretty good for an island whose population in 1901 was a million less than that of Scotland. Prof. Fischer also gives an excellent account of Corsica, although he says nothing about its British possession, by the will of the National Assembly of Corsica, from 1794 to 1796, when its viceroy was Sir Gilbert Elliot, first Earl of Minto, the great-grandfather of the present Viceroy of India. He appears, however, to have read the article by Mr. Ralph Richardson on Corsica, in this *Magazine* for October 1894, for, in connection with sport in Corsica, which possesses both the mouflon and the wild boar, he refers to the fact that "an Englishman expressed the belief that the Corsicans would find it to their advantage to turn their island into a great game-preserve for English and other sportsmen, resembling the Scottish Highlands." Like most writers on Corsica, he dwells at length upon the vendetta, but he forgets to award to its inhabitants a character they really deserve of being quiet, religious, and honest, nor does he mention that in no country do tourists travel with greater safety, or obtain more politeness and respect. There are other articles on Constantinople, Palestine, Italy, Spain, and North Africa, all marked by that keen observation and careful marshalling of facts which distinguish the erudite geographical traveller. We note that the University of Marburg, with less than a thousand students, has a Professor of Geography, while Edinburgh University, with more than three thousand students, has none.

Orkney and Shetland, Baddeley's Thorough Guide, with Approaches from Edinburgh, Thurso, and Oban. Illustrated with ten Maps by Bartholomew. Pp. 64. *Price* 1*s. net.* London: Dulau and Co., 1906.

Mr. Baddeley's little volume is now recognised as the tourist's best guide to the "Ultima Thule" of the British Isles. In this, the fifth edition, the work has been carefully revised, and several new maps with contour colouring have been added.

ASIA.

The Chinese at Home. Adapted from the French of Emile Bard by H. Twitchell. London: George Newnes, Limited, 1906.

A careful perusal of this book leaves us with the decided impression that it is merely one of the many books which were written to sell during the Russo-Japanese war, while the eyes of the Western nations were turned with interest to the East. The author describes himself as a man of affairs who has spent four years in China, a period surely much too short for the formation of a just, or even an useful, appreciation of the people of an empire of the size of China; and indeed one impression we get from the book is that the author has seen only one or two of the seaports, and perhaps Pekin, but knows nothing of the interior of the country. Nevertheless he claims "to have been careful not to fall into the spirit of systematic depreciation common to most Europeans in referring to the Celestial Empire and its inhabitants." Unfortunately a perusal of the book does not by any means support this claim, for it seems to us that from the first page to the last he has hardly a good word to say of the Chinese. Take, for example, the first four chapters. The first describes fairly enough the absurdly exaggerated and inconvenient system of etiquette in vogue in China; the other three are devoted to descriptions of their disregard for sincerity and exactness, misuse of time, and indifference to comfort. M. Bard has indeed a word of commendation for the purity of Chinese sacred literature and the absence of orgies and human sacrifices from their worship, but with this exception there is hardly anything Chinese which is not denounced more or less freely. The heading of the preface is the Italian proverb, *tutto il mondo è fatto comme la nostra famiglia*; the French nation, who are, we presume, the author's family, will not be flattered by the inference that China as described by M. Bard, is like France.

Calcutta, Past and Present. By Kathleen Blechynden. London: W. Thacker and Co.; Calcutta and Simla: Thacker, Spink and Co., 1906.

The title of this pleasantly written and very well illustrated book indicates very fairly the scope of the contents. The writer modestly claims for herself to be merely a gleaner in the fields which have been already reaped by such well-known authors as Yule, Wheeler, Forrest and others; and to those who do not care to tackle the more detailed and ponderous records of old Calcutta this little work may confidently be recommended. It contains a very readable mixture of history and gossip, and information more or less valuable; and it will certainly interest every one who has spent any time in Calcutta. The contrast between the old and the new is very effectively brought out; and many a one who has ridden or driven about the streets and suburbs of Calcutta, will be surprised and perhaps ashamed to find that he has, without knowing it, been daily passing through places and scenes in which the fortunes of the British Empire in India were often in jeopardy. The illustrations are exceptionally good, and for some it is claimed that they are unique.

AFRICA.

The Geology of South Africa. By F. H. Hatch, Ph.D., M.Inst.C.E., and G. S. Corstorphine, B.Sc., Ph.D. London: Macmillan and Co., 1905.

Geologists are indebted to the authors of this work for their strenuous endeavour to give a coherent description of the various groups of strata met with in South Africa. The geological literature relating to that region has now become rather extensive, and it was time that some one should undertake the task of preparing a reliable *résumé* or summary of the present state of our knowledge. This the authors have succeeded in doing, and have produced a well-illustrated volume which cannot but be of much service to practical geologists and mining engineers in South Africa. The book is hardly less welcome to geologists in this country who have not visited South Africa, to whom much of the literature is baffling and confusing, owing to the diverse grouping and nomenclature adopted by various authors. Messrs. Hatch and Corstorphine do not underestimate the difficulties of correlating groups of strata, many of which are apparently devoid of fossils, and it is quite possible, therefore, that future exploration and discovery may modify the classification they here advocate. The presence of many unconformities, moreover, must render the correlation of unfossiliferous rock-groups occurring in widely separated areas always more or less uncertain, no matter how closely these rock-groups may agree in lithological character. The authors arrange the rocks of South Africa in three great divisions, namely, "Pre-Karroo," "Karroo," and "Post-Karroo." Of these three the Karroo system is the best known to European geologists. It has long been famous for its reptiles, some of which, in the form of the skull and in the dentition, approximate in character to carnivorous mammals, while others recall in some respects the long-extinct labyrinthodont amphibians. Another remarkable feature of the Karroo system is its mixed flora—characteristic Carboniferous genera of plants occurring associated with Mesozoic types, such as *Glossopteris* and *Gangamopteris*. But perhaps the most astonishing feature is the presence near the base of the system of the "Dwyka Conglomerate," which in many places is neither more nor less than an ancient "boulder-clay" or ground-moraine, charged with glaciated stones and boulders, and resting upon a well-smoothed and ice-worn rock-surface. This remarkable boulder-bed has been followed through Natal, Cape Colony, Orange River Colony, and the Transvaal. It indicates the former presence of a *mer de glace* covering the northern part of South Africa, and flowing south into a great lake or inland sea, occupying practically the whole of what is now Central South Africa. The stratified character of the conglomerate along its southern extension would seem to show that, after the glacier entered the lake, its bottom-moraine was deposited by the agency of floating ice. In India and Australia the Permo-Carboniferous strata present similar phenomena. In both these regions we meet with a strange commingling of Carboniferous and Mesozoic plants, while glacial accumulations occur in connection with the plant-bearing strata. It seems not improbable, therefore, that in Permo-Carboniferous times a wide continental area may have connected India, Australia, and South Africa—forming the "Gondwanaland" of Professor Suess. In southern Cape Colony the "Cape system," which immediately underlies the Karroo beds, has yielded fossils which prove it to be of Devonian age. An enormous thickness of rocks occurs below the "Cape system," which, according to Messrs. Hatch and Corstorphine, form three separate systems, separated the one from the other by unconformities. No fossils, however, have yet been detected in any of those systems, which, as they attain a thickness of at least

45,000 feet, may well represent the period of time covered by the older Palæozoic rocks of Europe—the Silurian and the Cambrian.

The chief interest of these unfossiliferous deposits lies in the fact that they are the repositories of gold. Of the various "reefs" occurring in the "Witwatersrand system" the authors give an instructive description. They discuss very fully the petrographical character of the auriferous conglomerates, and are of opinion that, of the several explanations suggested for the origin of the gold, the "infiltration theory" is the most satisfactory.

The unfossiliferous rocks rest in their turn upon a vast series of gneissose and granitoid rocks, which the authors include under the head of "Archæan"—not that they correlate them with the ancient rocks known by that name in Europe, but simply indicate that they are the oldest rocks of South Africa. Everywhere gneissose and granitoid rocks form the basement on which the stratified rocks of South Africa are superposed.

So far, then, as research has gone, it would seem that rocks of Devonian age are the oldest fossiliferous strata hitherto met with. The Karroo system rests unconformably upon these, and represents the passage from Palæozoic to Mesozoic time. There is a gradual passage, in short, from Carboniferous to Upper Triassic or Rhætic, after which another great break in the succession occurs, there being no representative of the Jurassic system. The youngest strata, so far as known, belong to what is known as the "Coastal system," and are apparently of Cretaceous age. Various "superficial deposits" are distributed throughout South Africa, some of which may date back to Tertiary times, but the absence of fossils makes it impossible to classify all these accumulations according to age. Naturally the authors have much to say about the diamond-bearing deposits, and present their readers with a very clear description of the conditions under which the precious stones occur. As the book is certain to reach a second edition, the authors would do well to add another chapter for the sake of those who are neither professional geologists nor mining men. In this suggested chapter they might give a rapid *résumé* of the geology and a graphic sketch of the conditions that obtained during the formation of the several systems. Even mining men might be expected to read with interest all that the authors could tell them as to the shifting panorama of events revealed by the rocks, of whose contents and arrangements they have so much to say.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Tibet and the Tibetans. By the Rev. Graham Sandberg. Royal 8vo. Pp. x + 333. London : Society for Promoting Christian Knowledge, 1906. *Price* 5*s.*

A Summer Ride through Western Tibet. By Jane E. Duncan. Royal 8vo. Pp. xviii + 341. London : Smith, Elder and Co., 1906. *Price* 14*s. net.*

Florence. "Grant Allen's Historical Guides." New edition, revised and enlarged, by J. W. and A. M. Cruickshank. Crown 8vo. Pp. 303. London : E. Grant Richards, 1906. *Price* 3*s.* 6*d. net.*

Die Territoriale Entwicklung der Europäischen Kolonien mit einem Kolonialgeschichtlichen Atlas von 12 *Karten und* 40 *Kärtchen im Text.* Von. Prof. Dr. Alexander Supan. Gotha : Justus Perthes. *Preis* 12 *mark.*

The Face of the Earth (Das Antlitz der Erde). By Eduard Suess. Translated by Hertha B. C. Sollas, Ph.D., under the direction of W. J. Sollas, Sc.D.,

LL.D., F.R.S. Vol. II. Royal 8vo. Pp. vi + 556. London: Henry Frowde, 1906. *Price 25s. net.*

Pictures from the Balkans. By John Foster Fraser. Crown 8vo. Pp. xii + 298. London: Cassell and Co., Ltd., 1906. *Price 6s.*

No Man's Land: A History of Spitzbergen from its Discovery in 1596 to the Beginning of the Scientific Exploration of the Country. By Sir Martin Conway. Demy 8vo. Pp. xii + 377. Cambridge: University Press, 1906. *Price 10s. 6d. net.*

Geology: Earth History. By Thomas C. Chamberlain and Rollin D. Salisbury. Vol. II. Genesis—Paleozoic. Vol. III. Mesozoic, Cenozoic. Demy 8vo. London: J. Murray, 1906. *Price 21s. net.*

The Native Races of South Africa: A History of the Intrusion of the Hottentots and Bantu into the Hunting Grounds of the Bushmen, the Aborigines of the Country. By George W. Stow. Edited by George M'Call Theal, Litt.D., LL.D. Demy 8vo. Pp. xvi + 561. Swan, Sonnenschein and Co., Ltd., 1906. *Price 21s. net.*

Also the following reports, etc. :—

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Report on the Administration of the Punjab and its Dependencies for 1904-5. Lahore, 1905.

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The Burma Route Book. Part III. Routes in Western Burma, compiled in the Intelligence Branch, Quarter Master General's Department. Calcutta, 1905.

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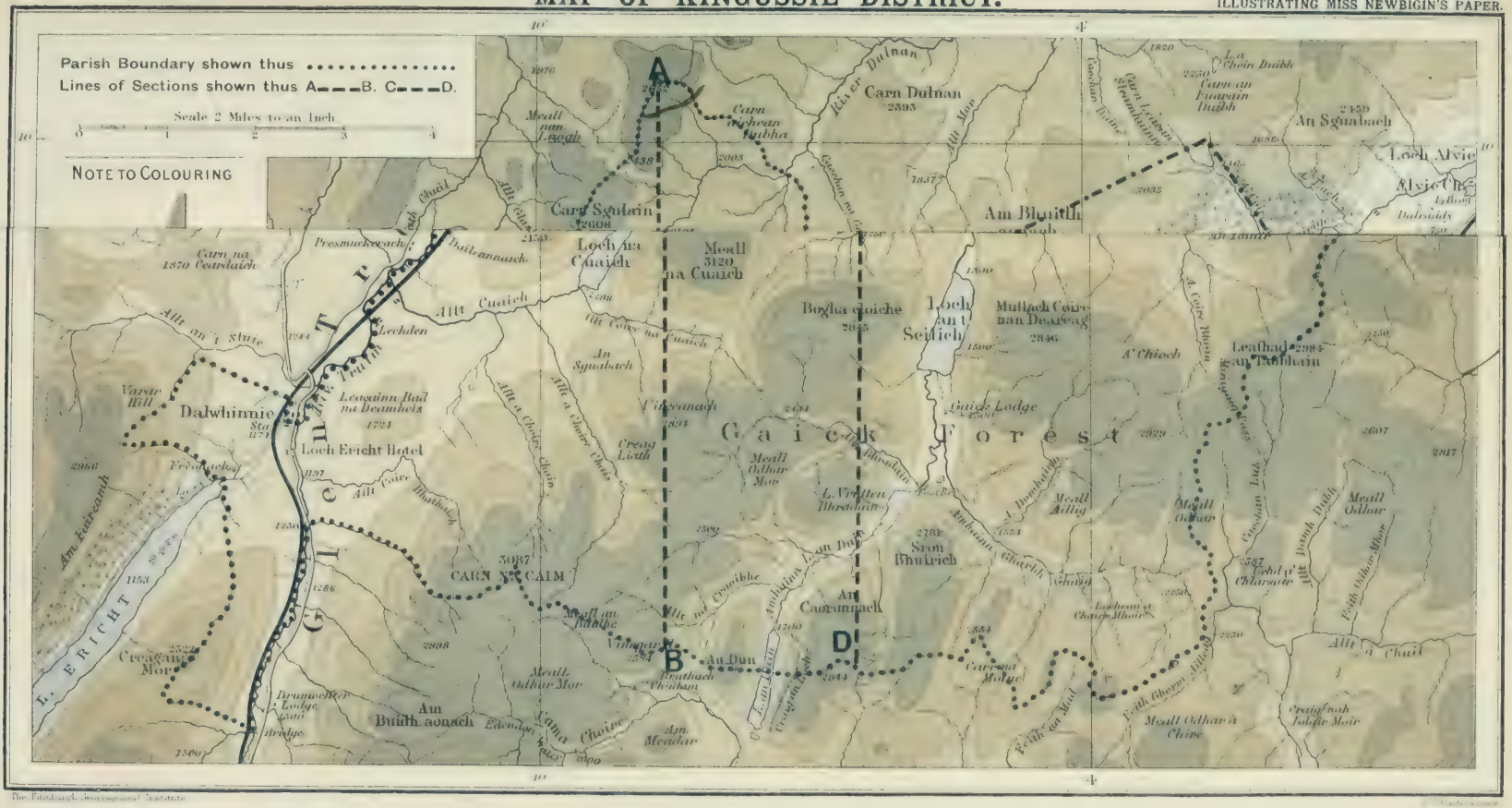

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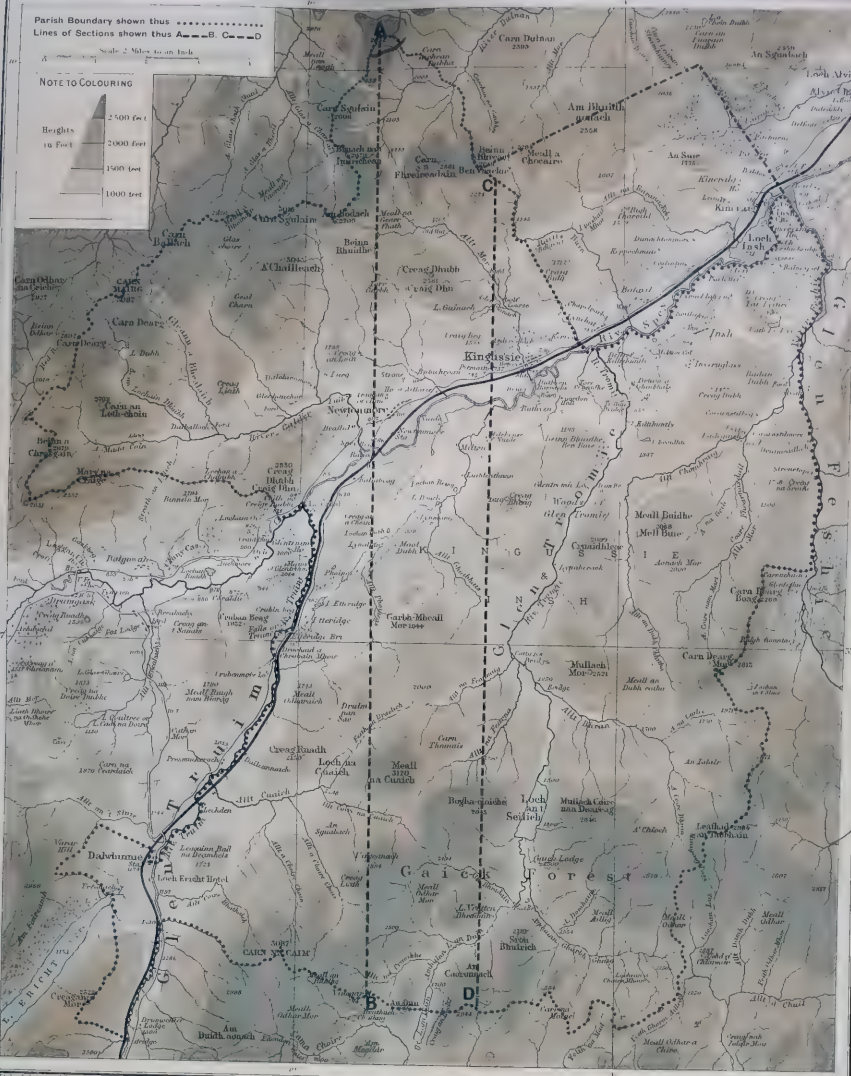
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BOTANICAL SURVEY OF SCOTLAND

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THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

FROM MOMBASA TO KHARTUM: THROUGH UGANDA AND DOWN THE NILE.

By Sir Charles Eliot, K.C.M.G., C.B.

In the lecture which I am about to give, I shall ask you to accompany me to the somewhat remote regions which contain the sources and upper waters of the Nile. I visited them myself in July and August 1902, travelling along the Nile, and often on it, the whole way from Lake Victoria to Khartum, Aswan and Cairo. Probably to most of my hearers Khartum will seem a distant spot in the heart of Africa, but to me, as I descended the river, it appeared as the beginning of civilisation and the fringe of Europe, and in this lecture I am almost entirely concerned with the Nile south of Khartum, and more particularly with the parts of it which lie to the south of the Sobat, that is to say those which lie between the Equator and eight degrees to the north of it.

Perhaps it may be well to briefly sketch the course of the Nile. It has a double course. That is to say it issues from the northern end of Lake Albert, but immediately before this river leaves Lake Albert, the lake receives another river coming from Lake Victoria on the east, and known as the Victoria Nile. Accordingly the stream which issues from Lake Albert is composed not only of the waters of that Lake, but also of the waters sent on from Lake Victoria which leave Lake Albert at very nearly the same point as they enter it. Lake Albert is also connected by the river Semliki with Lake Albert Edward, which lies to the south of it, and these three lakes, Victoria, Albert, and Albert Edward, are the reservoirs from which the Nile draws its waters until it reaches the Sudan, where it loses much of its bulk in swamps, but is also recruited by several important tributaries. The river which issues

from Lake Albert is known as the Bahr-el-Gebel or mountain river. For about 150 miles it is navigable though not deep, but after Nimule the rocks close round it and it is rendered impassable by rapids until near Gondokoro, from which point continuous navigation is possible up to Khartum. Gondokoro belongs to the Uganda Protectorate, but immediately beyond it begin the territories of the Egyptian Sudan, and the Nile undergoes a most curious transformation—one may almost say catastrophe—it spreads out into an enormous marsh in which it loses the appearance of a great river and becomes a swamp with a narrow and tortuous navigable channel, often very difficult to find. This is the region of the Sudd, of which more anon. Naturally the waste of water is considerable, and much of the water supplied by the Equatorial Lakes never gets through this marsh at all; but the loss is not apparent because, on coming out of the swamps, the river at once receives the large tributary known as the Bahr-el-Ghazal coming from the west. At the same time it makes a sharp bend to the east and shortly afterwards receives the Sobat on its right bank. It is now called the White Nile and resumes its northerly direction, and flows on about 840 miles to Khartum, where it receives the Bahr-el-Azrek or Blue Nile from Lake Tsana in Abyssinia. The total distance by river from Lake Victoria to Khartum is about 1700 miles.

These facts about the course of the Nile have only been known for certain in the last forty years. The honour of their discovery is divided between many eminent travellers, but perhaps the largest share of glory falls to Speke. In 1858 he made an expedition from the East Coast of Africa to the interior in company with Burton and discovered Lake Tanganyika. Burton fell ill, and Speke parting from him, struck to the north and discovered the southern end of Lake Victoria. A year or two later he organised a second expedition in conjunction with Grant, in which he not only increased our knowledge of Lake Victoria, but after many delays succeeded in making his way to Alexandria from that lake, and thus demonstrated that it is one of the sources of the Nile. He did not see Lake Albert, though he knew of its existence, and correctly marked its position from hearsay. This lake was first seen in 1864 by Sir Samuel Baker, who reached it from the north after meeting with Speke. Though the principal points in the course of the Nile had thus been established, much doubt and obscurity still prevailed owing to confused ideas respecting the basins of the Nile and Congo, which were not properly separated. The matter was cleared up by Stanley. In his first journey, in which he started from Zanzibar, he circumnavigated Lake Victoria and explored Uganda and the neighbouring countries. In his second and more celebrated journey he struck straight across Africa, and discovered among many other things Lake Albert Edward and the snow mountains of Ruwenzori.

On this occasion Stanley crossed Africa from west to east, but the easiest route for reaching the sources of the Nile is from the East Coast. We are apt to think of the Nile as a Central African river, and the traveller in its upper waters feels plunged in the inaccessible heart of the continent. But in reality the Nile is an East African stream. If

we take longitude 20°, which passes almost through the Cape of Good Hope, as marking the centre of the continent, the course of the Nile lies ten degrees to the east of this line, and its longest tributaries hardly come within five degrees of it, while, if we take the maximum breadth of Africa from Cape Verde to Cape Guardafui, the Nile will be found to be contained in the eastern third, and almost in the eastern fourth, of the continent. It will also be seen that all the great tributaries of the Nile, except the Bahr-el-Ghazal, come from the east. Lake Albert, however, is not inaccessible from the west. Steamers proceed up the Congo and its tributary the Aruwimi, and the Belgian Government are doing their best to improve the communication between the point where navigation stops and the shores of the Lake. But I believe there still remains an intervening region of thick forest which it takes some weeks to traverse. The journey from the East Coast, on the other hand, is surprisingly easy. As you are no doubt aware, a British line about 600 miles long, known as the Uganda Railway, connects Mombasa on the coast with Lake Victoria. A service of Lake steamers corresponds with the trains, and will take the traveller either to Entebbe, the official capital of Uganda, or to Jinja, at the point where the Victoria Nile issues from the Lake. The shortest and healthiest route is to avoid the Victoria Nile and march or drive straight across Uganda, to Lake Albert. From here a rowing and sailing boat can reach Nimule at the head of the rapids in about five days. From this point the traveller must march to Gondokoro, which takes about six days. At Gondokoro the river again becomes navigable, and a small steamer can proceed to Khartum without much difficulty. At Khartum one takes the railway to Wady Halfa. From Wady Halfa to Philae and Aswan is a journey of two days by steamer, and another day's rail brings one to Cairo. This is the route over which I ask you to accompany me. I myself did the whole journey from Mombasa to Cairo in 51 days, including several stoppages of two or three days on the way and an enforced detention of five days owing to the breakdown of a steamer. Now that the steamer service is better arranged, I should think the distance might easily be covered in five weeks, allowing for time to look round on the way, and if any one organised his journey carefully beforehand, and was willing to travel quickly, I think he ought to be able to reach Cairo from Mombasa in a month.

Mombasa, the terminus of the Uganda Railway on the Coast, is an old Arab settlement, first made known to Europeans by Vasco da Gama, who touched there during his first voyage round the Cape to India in 1498. It is situated on a small island surrounded by considerable harbours on two sides, but so closely fitted into the coast that its separate existence is not discernible on the map, though the channel which divides it from the mainland is wide enough to require a considerable bridge. However, it is not my purpose to-night to describe the Uganda Railway, and I must hurry over it with a rapidity out of all proportion to the rate of the train, which does not number speed among its many excellences. The first two hundred miles of the journey are spent in traversing a jungle, after which the train emerges upon plains about

5000 feet high and remarkable for their fine climate as well as for the number of zebras and beautiful wild antelopes which they support. After mounting to a height of 7000 feet, the railway descends into a great depression called the Rift Valley, consisting of a huge natural trough containing a series of lakes. There are two of these troughs in the Eastern side of Africa: first of all the present one, about 350 miles from the sea, extending into Abyssinia in the north and German East Africa in the south, and containing Lakes Naivasha, Rudolf, and others; secondly, a larger depression about 300 miles further to the west, containing Lakes Tanganyika, Kivu, Albert Edward, and Albert. It is from this second valley that the Nile issues, and it is hence sometimes called the Nile Rift Valley; but it must be remembered that, though Lakes Albert and Albert Edward are connected by the Semliki river, and Lakes Kivu and Tanganyika by the Rusizi, there is no connection between these last two and Lake Albert Edward, and they cannot be said to in any way contribute to the formation of the Nile.

After traversing the first of these Rift Valleys, the railway scales the very considerable elevation known as the Mau Escarpment, and attains a height of 8000 feet, after which it descends rapidly, by means of a striking system of viaducts, more than 4000 feet and reaches the shores of Lake Victoria, which are about 3800 feet above the sea level. We must pay a little more detailed attention to this great sheet of water, as it is one of the principal sources of the Nile.

It lies between the two Rift Valleys already mentioned, but does not belong to either of them, and it seems equally certain that it is not an old arm of the sea, as so many African Lakes have been supposed to be, but merely a depression in which the rain which falls on the surrounding country collects. At least fifteen rivers flow into it and become considerable streams in the wet season when the rain is prolonged and heavy. The largest of them is the Kagera, which may thus be regarded as one of the ultimate sources of the Nile. The country within a few miles of the Lake shore is in most parts swampy and unhealthy for Europeans, though thickly populated by natives. But even these latter suffer severely from sleeping sickness, an incurable disease which seems to be transmitted by the bite of a fly that lives in trees near water.

Unlike the Albert Nyanza and many other African lakes, Lake Victoria is not very picturesque, and at any rate in British territory affords few fine views. This is because the shores are low and indented and often fringed with islands, so that the water seen at many points—for instance Kisumu, the railway terminus—is not the whole lake, but merely an arm or bay. But the dimensions are imposing, as the whole sheet of water is about 265 miles long from north to south, and about 215 broad. The steamer usually takes more than twenty-four hours to cross, as it stops to take in wood fuel and does not travel at night because islands are numerous and imperfectly surveyed.

The Victoria Nile issues from this lake at Jinja, about the middle of the northern end just above the Equator, and the point of exit is known as the Ripon Falls. Considered as a water-fall this

cascade is not remarkable, for the drop is small, but the immense volume of blue water rushing between a gorge of red cliffs is an impressive sight. In the midst of this whirling stream are a few quiet pools formed by the backwaters of the eddies. The fish who are carried down by the river collect in them and appear to be quite dazed and stunned, so that the natives are able to spear them from the bank with long poles. Water-birds also avail themselves of the dazed condition of the fish, and may be seen swimming about in the still pools capturing enormous quantities of prey.

On leaving the Ripon Falls the Nile proceeds almost due north, and after about 75 miles reaches a large but very irregularly shaped lake called Choga or Kioga, through which it runs for about 50 miles. This lake is really little more than a swamp, for it is very shallow, and large parts of its surface are covered with floating weeds. On leaving it, the river runs first north and then west to Lake Albert, and shortly before reaching that Lake dashes through a narrow gorge and forms what are known as the Murchison Falls. They are steeper and narrower than the Ripon Falls, and present a curious appearance as the flow of the water into the pool below is not regular, but consists of a series of interrupted waves accompanied by a curious intermittent roaring. It would appear that the river rushing down the long water-slide encounters some rocky obstacle just before it enters the pool. It rebounds from this obstacle, but of course the water behind follows immediately on the top of it. Seen from below, the effect presented is a mass of water tumbling headlong into the pool and interrupted at intervals by an enormous broken wave. The drop is about 120 feet, and the basin is surrounded by quantities of crocodiles, which may often be seen basking in the sun, literally piled one on the top of another. All the country about Lake Choga is very unhealthy, and as the Murchison Falls effectually prevent every kind of navigation, it is not likely that the Victoria Nile will ever be of much importance. It is not, as a rule, followed by those who wish to go from Uganda to Egypt by the Nile.

The easiest method of reaching Lake Albert and the Bahr-el-Gebel is to avoid the Victoria Nile altogether, and to strike straight from Entebbe or Kampala across the kingdom of Unganda to Butiaba on the shores of Lake Albert, a distance of about 160 miles. I drove the whole way myself, as there is a good broad road connecting the two lakes which can be used by either carriages or motors, though its ups and downs are somewhat severe, owing to the uncompromising manner in which it scales elevations and passes through the middle of swamps, disdaining to make the smallest curve to the right or left. But on the whole it is a broad fine road, such as one is very thankful and rather surprised to find in Equatorial Africa. I was able to traverse the distance in a little over four days owing to the authorities having provided relays of mules every ten or twenty miles, but it has been found impossible to maintain these stations permanently, as neither horses nor mules thrive in this part. The almost invariable method of travelling in this country is marching, that is to say, walking from eight to twelve miles a day with a

caravan of porters. The African races have a real genius for porterage, and it is perhaps characteristic of them that they regard the head mainly as an organ for bearing burdens, and do not associate it with thought or intellect. It is surprising to see how they will throw a box weighing 60 lbs.—the regulation weight—on to their heads, and walk bearing it in this position for three or four hours with a perfectly erect carriage. Some tribes put the burden on their backs, but even then they support it by a strap running round the forehead, on which a great part of the weight thus falls.

The country beyond Lake Victoria which we are now traversing is called Uganda, but I must warn you that this name has a double significance. There is the Protectorate of Uganda, and the Kingdom of Uganda. The former is the general designation for all our territories in East Africa north and west of Lake Victoria, those to the east being called East Africa. The Kingdom of Uganda, though perhaps the most important part of the larger protectorate to which it gives its name, is a relatively small native state lying on the north-west shore of Lake Victoria and extending in the direction of Lake Albert until it meets another native state called Unyoro.

Uganda is, perhaps, for the general public, the best-known name in the Eastern part of Africa. Though it is a considerable distance from the coast, it attracted attention and interest in England from the time when it was first visited by Stanley in 1875, long before we began to concern ourselves actively with the affairs of more accessible places such as Zanzibar and Mombasa. It was mainly the feeling that we could not abandon Uganda that led to the construction of the railway from Mombasa to Lake Victoria and the establishment of our East African Empire. The country is remarkable and almost unique in tropical Africa, in possessing a large and most intelligent native population, who have shown an aptitude for assimilating European education and European material civilisation which can only be paralleled in Japan. In the space of thirty years the whole country has become at least nominally Christian, and all the children learn to read and write the Roman alphabet. The difference between Uganda and the surrounding countries will be clear, if I say that in the whole stretch between the coast and Lake Victoria there is nothing constructed by natives which can be called either a town or a road, for before the arrival of Europeans there were only jungle paths and a few villages, hidden as much as possible in the woods; there was nothing which could be called a state or a government, and the chiefs, as a rule, had authority only in their own villages. Many of the tribes went absolutely naked, and all were, according to our ideas, very imperfectly clad. It must be added that most of these tribes have shown very little capacity for advancing beyond this condition. In Uganda, on the contrary, when it was first discovered, there was a well-developed social system with lower and middle classes, a territorial aristocracy, and a central government culminating in a king and an elaborate court; the people were clothed in flowing garments made of fibrous bark, and the capital had a population of 80,000 and contained large wooden houses, which, if not very magnificent according

to our ideas, may be called palatial in comparison with the huts generally built by African natives. The government, it is true, was marked by great cruelty and tyranny, but it showed a genuine desire to unite the whole people in one state, an idea totally foreign to most savage tribes in Africa. Under British guidance this government has been transformed into a constitutional monarchy, which appears to work satisfactorily. The change is perhaps facilitated by the fact that the present king, who has already been on the throne about six years, is a minor aged eight or nine, who is thus growing up among new conditions and becoming gradually accustomed to them. At present authority is vested in three regents and in an elective parliament, and there is a well-organised system of administering justice and an effective police force. The remoteness of Uganda has somewhat hampered its development, but the natives possess two qualities which ensure that they will in the future play a prominent part in these regions. First, they are anxious to purchase European goods, not merely toys, but machinery and building materials. Even five years ago many of the chiefs had electric bells in their houses, and there is a general desire to develop the resources of the country by European methods. Secondly, the people have a passion for education. It is a reproach not to be able to read, and there is probably no country in the world where missionaries have received so hearty a welcome or made such striking progress.

All this part of Africa—and one may perhaps say all tropical Africa except such parts in the south and east as form high, open plains—is remarkable for the thickness of its vegetation, and one result of this is that the population and their houses are much less conspicuous than in other countries. Kampala, the capital of Uganda, is built, like Rome, on seven hills, and as most of them are crowned by a building of some size, such as a cathedral, a palace, or a fort, the site is conspicuous from a distance. But when one looks down on the city from the top of one of these hills, one sees few traces of its 80,000 inhabitants, but merely a sea of deep green. This is because all the houses are built within gardens containing banana-trees, which surround and overshadow them. The same feature is still more remarkable in the interior. As one travels across the country, one seems to be always going through a forest or between tall grass. Though there are many large and gorgeous flowers in Africa, they do not often grow in masses or sensibly affect the colour of the landscape, which is generally deep, dead green. One passes houses now and then on the road, and sees people going to or from market, but the towns are in general hidden, and considering the density of the population and the numbers of wild animals in the country, the signs of both man and beast are surprisingly small.

About twenty-five miles from Lake Albert, one passes through the large town of Hoima, the capital of Unyoro, a native state similar to Uganda, but less known and less progressive, inasmuch as it is further from the coast. The first view of the lake is sudden, and strikingly unlike Lake Victoria. It is surrounded by high cliffs which leave only a narrow rim of flat shore between their base and the water, and as one comes from the east one issues from a forest, turns a corner, and in the twinkling

of an eye sees the whole panorama spread below. When I saw the lake it was largely of a bright green colour, due to the presence in enormous quantities of some minute organism which renders it unfit for drinking. But I believe that this phenomenon is only occasional.

Lake Albert is connected by the river Semliki with Lake Albert Edward, which must therefore be regarded as one of the ultimate sources of the Nile. I have never visited it, but it is described as surrounded by high mountains, except at its southern end. The most remarkable of these is Mount Ruwenzori, perhaps the largest snow mountain or range of mountains in Africa.

The whole of this region is very subject to haze and fog, and Ruwenzori is sometimes invisible for months together. Many explorers had been quite near it without seeing it, before it was discovered by Stanley in 1888. It is probably the range called by ancient geographers the Mountains of the Moon, and has been recently ascended to a height of about 16,000 feet.

From Lake Albert to Nimule at the head of the first rapids, I proceeded in a large boat, using a sail when necessary, but generally relying on the strength of twelve native oarsmen, who rowed with unfailing regularity from sunrise to sunset, hardly seeming to care for an hour's rest in the middle of the day. This section of the Nile is perhaps the most beautiful and interesting in the whole river, excepting only Egypt itself. It is called the Bahr-el-Gebel or Mountain Nile, and both its banks are bordered by a low range of mountains, which is generally, however, at some distance from the stream. In places, particularly near Lake Albert, the banks are fairly high, but they are often quite low, the river being bounded by a shallow marsh, which renders landing extremely difficult, though it often improves the landscape, as it is covered with blue and white water lilies, and other beautiful flowers. Another vegetable which is quite a feature in the river scenery, though neither a beautiful nor a useful one, is a floating plant something like a cabbage, which may be seen sailing down the stream, trailing long roots behind it. This plant does not do much harm in this part of the Nile as it subsequently gets dashed to pieces on the rapids, but further down it gets entangled with the reeds and papyrus, and helps to form that formidable vegetable barrier called the Sudd, which long obstructed navigation in the Sudan, and of which I shall speak later.

Unlike the silent forests of Uganda, the waters and banks of the Bahr-el-Gebel are full of animal life, particularly birds. Incredible numbers of long-legged storks, cranes, and herons stand among the rushes, presumably watching for fish, but apparently contemplating the scene. Conspicuous among them are the beautiful crowned cranes, who have a crest of plumes on the head like a diadem, and the *Balæniceps rex*, a huge blue stork, with a broad bill shaped like a boat. Other kinds of birds run about on the flat leaves of the water-lilies, and seem to rarely venture either into the water or on to the land. Others build hanging, bottle-shaped nests on trees, and sometimes a whole colony will take possession of a tree and cover it with many hundreds of these nests.

But the most remarkable and conspicuous animal to be seen in the river is the hippopotamus. They are extremely common, particularly in quiet pools and backwaters, where parties of twenty or thirty may often be found together. The hippopotamus when taking his ease on the shore is rather like a huge pig with a monstrously developed head, and in this part of the world, at any rate, is often quite light and almost pinkish in colour. On land their movements seem clumsy, but once in the water they are extremely active, if not precisely graceful. They appear to have the power of walking on the bottom of rivers, and the females carry their young on their backs, but from time to time they come up to the surface to breathe or bask in the sun. In districts where they have been shot at, they are extremely cautious and lie just below the surface, showing nothing but the tips of their ears and their nostrils, so that they are almost invisible, but in these wild countries where they have never been molested they throw their whole head out of the water backwards and take an enormous gulp of air. At first the effect of all these huge creatures rising round the boat was very alarming, but they appeared to be quite harmless and showed no disposition whatever to attack. It would appear that the hippopotamus is naturally a very inoffensive animal, but in some districts they have discovered that natives carry grain in boats. When once they acquire this knowledge they become extremely dangerous, for they will deliberately upset anything they find on the water in the hope that it may contain grain.

The human inhabitants of this district are known by various names, such as Madi and Bari. They differ in language, and to a certain extent in customs, but are clearly allied to one another, and form a distinct sub-division of the human race. Though they are dark in colour, they are not at all like the people who are commonly known as negroes, and I may perhaps remind you that this word negro is not really a general name for the natives of Africa, but is properly applied only to the inhabitants of the West Coast and the Congo. The natives of all those districts were in former times exported as slaves in considerable numbers to North America, the West Indies, and Brazil, in all of which countries they now form a considerable proportion of the population; but most of the natives of East Africa, as well as the Zulus, Kaffirs, and other tribes of South Africa, belong to other races and often have not flat noses, thick lips, or woolly hair. The tribes who live by the Nile have a very distinct physical appearance. The men are nearly all tall, with long thin limbs, and their features are sometimes almost European in regularity, though often spoilt by knocking out the front teeth or cutting gashes in the cheeks. They have a curious habit of resting standing on one leg, placing the foot of the other against the ankle of the leg on which they are standing, and will remain for long periods in this position. But the most remarkable point in their appearance is that, although they are by no means savages, all the male sex go absolutely naked, and consider it derogatory to the dignity of a man to wear any clothes. By way of ornament they sometimes wear in their under lip one or two skewers made of polished glass, and they

are very anxious to obtain bottles from Europeans in order to grind them down. They also sometimes wear a helmet made of the hair of their ancestors matted into a sort of felt and covered with a pattern in white beads. Even the women, though they wear a certain amount of clothes, must be regarded as belonging to the class of light dressers, and their costume consists largely of head-dresses and beads. Their villages are circular and surrounded by a wooden fence. In the middle are the store-houses for grain and other provisions, set on poles about 4 feet high to keep them out of the reach of animals, and also a few platforms 10 or 12 feet high. These latter are used as places of repose when mosquitoes are intolerably abundant, for the mosquito rarely lives far above the ground. The dwelling houses are circular huts made of wood and thick straw, sometimes with foundations in stone.

But in all this district, though the population is not really scanty, the banks of the river seem very deserted, and one does not see more than two or three villages on the banks in the course of a day. This is because of the fear inspired by the Dervishes in former times, which drove the inhabitants away from the river and led them to build most of their villages about ten miles from the bank. You are no doubt aware that these Dervishes have played a considerable part in the history of the Sudan and the Equatorial Provinces to the south of it. As far as I know, nothing whatever is known of the history of those countries before the beginning of the last century. About 1820 the Egyptian Government founded Khartum, and during the next fifty years gradually extended its power to the south, largely through the assistance of Europeans like Sir Samuel Baker. But in 1882 a double rebellion broke out. Arabi Pasha revolted in Lower Egypt, and at the same time a religious fanatic known as the Mahdi rose in the Sudan. He annihilated the forces of General Hicks and subsequently of Gordon, and for about fifteen years his followers, known as the Dervishes, were masters of the Sudan, and though they did not permanently occupy any country near Lake Albert, they occasionally raided the upper reaches of the Nile. Their power was destroyed, as you know, by Lord Kitchener at the battle of Omdurman in 1898.

When the Mahdi's rebellion broke out and Gordon was imprisoned in Khartum, a celebrated man was governor on behalf of Egypt of the Equatorial Province, and resided at Wadelai, about two days' journey down the Nile from Lake Albert. This was Emin Pasha, a German whose real name was Schnitzen. Owing to the Mahdi's revolt he was entirely cut off from communication with Egypt and the Sudan, and seemed to have disappeared. Stanley's celebrated expedition in 1889 was made with the object of rescuing him, and he was found living safe and sound at Wadelai and maintaining order in the district. Up to that period whatever civilisation was to be found on the upper waters of the Nile had penetrated southwards from Egypt, but after Stanley's great journey, Europeans began to frequent Uganda, whereas the Sudan remained in the hands of the Mahdi for some time. Hence the old Equatorial Province of Egypt was broken up. The Sudan, of which Khartum is the capital, extends southwards to about Gondo-

koro, and the country south of this belongs to the Protectorate of Uganda and has nothing to do with Egypt. But until we reach the territory of the Sudan, only the right or east bank of the Nile is actually occupied by Great Britain. Though we have the same rights over the west bank, we have leased it to the Belgians in order to enable the Congo Free State to have an outlet on the Nile.

On arriving at Nimule a new section of the journey begins. You are no doubt aware that the course of the Nile is interrupted from time to time by rapids which render navigation impossible and seriously impair the river's value as a commercial highway. The first of these rapids begin immediately after the British station of Nimule, and for practical purposes may be said to continue until Rejaf and Gondokoro, although there are patches of navigable water here and there in this part of the river's course. The scene at the commencement of these rapids is most impressive. You will understand how great and unusual are the forces brought into play when I say that above the rapids the river is nearly four hundred yards wide, and that soon after entering them the same volume of water is forced through a channel only fifteen yards wide, of unknown though clearly very great depth. At the end of this channel the river leaps down into a sort of caldron or pot which is only fifty yards long and twelve wide, and which appears to be filled with boiling water. The scene cannot be adequately represented by any photograph. The rocks which form the sides of the channel and the caldron are of the deepest black, and have been worn by the current until they shine like polished marble. The contrast between these black glittering stones, the white foaming river, and the green vegetation on the bank is intensified by the rich light of the tropical sun, but perhaps the most impressive feature in the picture is the immense force and fury of the water which is thus able to cleave a passage for itself through the heart of the solid rock. The rapids continue for about 110 miles, but after this first commencement do not present any remarkable views. When the river finally issues from them, it is a fine stream 400 or 500 yards in width.

The rapids naturally oblige the traveller to leave his boat and to march a distance of about 120 miles from Nimule to Gondokoro. The route followed is called a native path, but, as often in Africa, it is useful simply to indicate the direction and makes not the smallest attempt to facilitate progress. For a great part of the way the road lies through tall grass, 5 or 6 feet high. This grass is covered with thick dew until about ten in the morning, and the consequence is that during the earlier part of the day the traveller is generally soaked to the skin. The district, however, contains some beautiful country. Every now and then the jungle broadens out into wide meadows studded with fine shady trees, and it appears that in such localities the climate is healthy and agreeable. The natives of this district are much the same as those I have already described,—tall, naked, long-limbed men. Perhaps the best known of them are the Latuka, a warlike tribe who are ruled by a Queen. They are workers in metal and wear brass helmets with red plumes.

Gondokoro is a place of some importance for this part of the world.

It is here that regular steam navigation commences, and there is monthly communication by steamer with Khartum. Ever since 1840 this district, including Gondokoro and a pyramidal hill on the other side called Rejaf, had been the administrative centre for this part of the world, and is associated with the name of a very eminent Englishman who rendered great services to Africa, Sir Samuel Baker. He not only discovered Lake Albert, as I have already mentioned, but spent four years administering the countries of the Upper Nile and suppressing the slave-trade. In the sixties that was no easy task.

Gondokoro practically marks the boundary between the Uganda Protectorate and the Sudan and also an entirely new stage in the development of the Nile. I have described to you how it was in one place contracted to a cataract only 15 yards broad. It now spreads out into an enormous marsh some 450 miles long, and of a breadth which is not accurately known but which must amount to many miles on either side of the central channel. At first the stream merely becomes broader and splits up into several channels divided by islands, but gradually the banks become lower, the trees smaller, and the rushes taller until by the time one reaches Bor, about 120 miles to the north of Gondokoro, the Nile may be said to have no banks at all and to have entirely lost the appearance of a river. The whole region is one of the strangest and most desolate countries in the whole world. The course of the river sometimes widens out into lagoons, but is generally represented by a narrow and extremely tortuous channel confined between two dark green walls of papyrus. This papyrus is the reed which was used by the ancient Egyptians for making paper. It is a tall rush perhaps 15 feet high, with long dark-green leaves among which rises a feathery shaft. It grows in incalculable quantities, and when it once takes possession of a locality it seems to drive out all vegetation except other water plants which thrive among its roots. For about five days the steamer wanders in this marshy maze, sometimes actually going southwards in order to follow the bends and twists of the channel, but rarely meeting anything to break the monotony. Not a hill or a village or a tree or a flower are to be seen, only miles and miles of tall green rushes. Agreeable forms of animal life are scarce, and the general impression left is that there is little life in the swamp; but crocodiles are plentiful, and it is difficult to find any language to describe the abundance of mosquitoes. To give you an idea of the numbers, I may say that there was a small table on the deck of the steamer on which stood two lamps. In the morning one often found this table covered with a layer half an inch thick composed of half-dead mosquitoes.

This is the region of the Sudd. Sudd is an Arabic word meaning barrier, and it is applied to the immense masses of water plants which from time to time block the course of the Nile and prevent boats from passing. This obstruction is formed by the roots of the papyrus and other reeds, which grow together and unite with the soil to form a compact mass. When, as is frequently the case, violent storms sweep over the swamp, large masses of these roots, with the earth and mud

attached to them, are torn off and driven before the wind like floating islands. They soon collide and become piled one upon the top of the other, layer upon layer, leaving the water to force its way under them as best it can. The river thus becomes covered with a coating of earth and vegetable matter 10 or even 15 feet thick. In the year 1900 this monstrous growth entirely obstructed navigation between Khartum and Gondokoro, with the result that all communication was stopped until after long and arduous labours English engineers succeeded in cutting through the principal blocks of Sudd and opening a free channel for the river.

At the northern end of this swamp is a lake called No, so overgrown with weeds that it is impossible to say what its size may be. At this point the river turns sharply to the east, and at the same time receives a large tributary from the west. This western tributary is the Bahr-el-Ghazal, and the whole river flowing to the east and onwards to Khartum is henceforth known by the name of the White Nile or Bahr-el-Abyad. The Bahr-el-Ghazal is a large river, and receives many tributaries from the south coming from the country of the Niam-Niam, who have an evil reputation as cannibals, but it is sluggish and so choked with weeds that it contributes little to the volume of the Nile. The countries which it irrigates, or rather inundates, are among the most unhealthy and unpleasant in Africa. They are little but a succession of steaming fetid marshes, where even the native inhabitants often remain in the water with only their heads exposed in order to escape the attacks of the venomous mosquitoes.

It is an indescribable relief to at last leave these swamps. The White Nile cannot be called beautiful: the scenery which it offers all the way to Khartum is flat and uninteresting, but at least it has raised banks, one sees trees and villages, and the stream flows unchecked and freely. Soon after taking the turn to the east, it receives a tributary known as the Bahr-el-Zaraf, which also comes from the papyrus swamps, and shortly after this there flows into it the very important river called the Sobat, whose discharge has from this point onwards a considerable effect on the volume of the Nile. Its waters are at certain seasons of a creamy white, and the name White Nile is probably due to the milky colour which it imparts to the whole river when in flood. Its banks are high, and it traverses a rich alluvial plain inhabited by a tribe called Shilluks, who are similar to the other Nilotic tribes whom I have mentioned, and possess large herds of cattle. The Sobat drains a large area of the Southern Abyssinian plateau, but its more distant tributaries are very little known.

After receiving the Sobat, the White Nile takes a northerly direction until it reaches Khartum. Almost the only point of interest in this long stretch is Fashoda. You will remember that in 1898 this point was occupied by M. Marchand, a leader of a French expedition coming from the west, and the French flag hoisted then, with the result that serious international trouble was threatened, although it was happily averted, and the French recognised the rights of the Egyptian Government over the locality. When one sees Fashoda, which

is little more than a cluster of huts on a swampy backwater, one's first thought is amazement that two great nations can have nearly been at war about so remote and miserable a spot. But a glance at the map will show the importance of the position. Had the French been able to claim the country extending from the French Congo to the borders of Abyssinia and conceivably as far as the French possessions on the Gulf of Aden, they could have prevented any of those projects which are now being discussed for controlling the rise and fall of the Nile, and would have been able to affect the supply of water on which the prosperity of the Sudan and all Egypt depends. As it is, the whole course of the Nile runs through British or Egyptian territory.

At Khartum the river receives an important accession in the Blue Nile. Strictly speaking, Khartum is a small European settlement on the east bank of the river, and the more important locality is the large native town of Omdurman on the west side, which was the headquarters of the Mahdi. The Blue Nile and its tributaries water the most fertile and prosperous parts of the Sudan. We are now out of the region of the wild tribes of the Upper Nile, and the inhabitants are semi-civilised Arabs, Egyptians, Abyssinians, and tribes akin to the Somalis. The Blue Nile takes it rise in Lake Tsana in Abyssinia and owes its name to the beautiful limpid blue colour of its water. It is very different in character from the White Nile, which we have hitherto described. In its higher reaches it is a rapid mountain stream dashing down through a region of rocks and forests in a gorge several thousand feet deep. As it nears the plains, these features are naturally modified, but even here the banks are high and wooded and the stream rapid. At Khartum we meet the railway and are in touch with civilisation, and here too the Nile attains practically its full volume. It receives, however, one more tributary at Berber, the Atbara, which also comes from Abyssinia and the neighbourhood of Kassala. It is sometimes called the Black Nile, and is the principal source of the black sediment which is carried down to Lower Egypt and makes the lands on which it is deposited so extraordinary fertile. Both the Atbara and the Blue Nile are flood rivers, that is to say, at certain times of the year their volume suddenly increases, and there is a very marked difference between their maximum and minimum size.

Note.—This paper is based in part on a lecture delivered before the Society in Edinburgh on November 28, 1905.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.[1]

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART IX.—THE LOCHS OF THE SHIN BASIN.

IN this paper it is proposed to deal with the lochs visited by the Lake Survey draining by the river Shin and river Oykell into the Dornoch firth, viz. Lochs Shin, Merkland, a' Ghriama, Fiodhaig, Gorm Loch Mòr, Ailsh, Craggie, an Daimh, Migdale, and an Lagain, and it has been found convenient to include also Loch Buidhe, flowing by the river Fleet into Loch Fleet, lying to the north of the Dornoch firth. The drainage area to be dealt with extends from Tarbat Ness on the east to Cnoc a' Choilich (little more than 3 miles from the shores of Loch Broom) on the west, and to Ben Hee and Carn Dearg on the north, the total area being about 860 square miles, of which about 770 square miles drain into the Dornoch firth, and about 90 square miles into Loch Fleet. Of this total about 240 square miles drain into the lochs under consideration. The principal loch is Loch Shin, one of the largest of Scottish lochs, the others being comparatively small, Loch Merkland being the only one exceeding 2 miles in length. Loch Shin receives the outflow from Lochs Merkland and a' Ghriama at its northern end, and the outflow from Loch Fiodhaig about 5 miles down on its eastern shore. Gorm Loch Mòr lies at the headwaters of the river Cassley, a tributary of the river Oykell, and Loch an Daimh flows by the river Einig into the river Oykell, which also receives the outflow from Lochs Ailsh and Craggie. The river Shin, bearing the outflow from Loch Shin, joins the river Oykell to form the Kyle of Sutherland at the head of the Dornoch firth. Loch Migdale flows by a short stream into the Dornoch firth on its northern side, and Loch an Lagain flows by a longer stream (the river Evelix) also into the Dornoch firth on its northern side. Loch Buidhe flows by the river Torboll into the river Fleet at the head of Loch Fleet. The boundary-line between Ross-shire and Sutherlandshire follows the course of the river Oykell from the head of the Dornoch firth to Breabag Tarsuinn, passing up the middle of Loch Ailsh, which thus lies partly in Ross and partly in Sutherland, while Lochs Craggie and an Daimh are located in Ross-shire and the remaining lochs under consideration in Sutherlandshire.

Loch Shin.—Loch Shin is the largest loch in Scotland to the north of Loch Ness, and as regards length it ranks fifth of all Scottish lochs, being exceeded in this respect only by Lochs Awe, Ness, Lomond, and Shiel. It is a fine sheet of water situated amid beautiful scenery, with Ben More, Assynt, and Coniveall rising to heights exceeding 3200 feet

[1] Abbreviated from article, with maps, in *Geographical Journal* for November 1905.

on the west, and Meall an Eoin (3154 feet) on the north-east. It is a good trout loch, containing also *Salmo ferox*, and the islands are much frequented by wildfowl. It trends in a north-west and south-east direction, and the length measured along the centre of the loch is about 17¼ miles. The loch is on the whole very narrow, the maximum breadth exceeding 1 mile at the junction with the small arm leading to Loch a' Bhainbh, and also at the position of the delta formation at the mouth of the river Fiodhaig. Elsewhere the breadth is considerably less than a mile, and the upper portion, to the north-west of the entrance of the river Fiodhaig, is all less than half a mile in width. The mean breadth of the entire loch is half a mile, or only 3 per cent. of the length— a percentage smaller than has been observed in any other loch except Loch Shiel. The waters of Loch Shin cover an area of about 5570 acres, or nearly 8¾ square miles, and the area of land draining into it is over 150 square miles, but as it receives the outflow from Lochs Merkland, a' Ghriama, and Fiodhaig, its total drainage area is over 190 square miles—an area twenty-two times greater than that of the loch. Over 800 soundings were taken, the maximum depth recorded being 162 feet, about 7 miles from the foot of the loch, opposite the little Loch an Fhreiceadain on the north-eastern shore. The volume of water contained in the loch is estimated at 12,380 millions of cubic feet, and the mean depth at 51 feet, or 31½ per cent. of the maximum depth. Loch Shin was surveyed on August 25 to September 1, 1902, when the elevation of the lake-surface above the sea was determined by levelling from bench-mark as being 270·85 feet; when levelled by the officers of the Ordnance Survey on August 4, 1870, the elevation was found to be 269·7 feet above sea-level. The farmer at Overscraig stated that the water might fall 1 foot below, and rise 6 feet above, the level at the time of the survey.

The floor of Loch Shin is very irregular. None of the contour-lines are continuous from end to end of the loch, and the lines themselves are usually of a sinuous character. The 25-feet contour encloses two areas, the 50-feet contour three areas, the 100-feet contour four areas, and the 150-feet contour two areas. The lower 25-feet basin is nearly 10 miles in length, extending from close to the lower end of the loch as far as the alluvial cone at the mouth of the river Fiodhaig. Here for an interval of nearly half a mile the soundings indicate depths less than 20 feet, except for an isolated sounding of 25 feet towards the north-eastern shore. The upper 25-feet basin is nearly 6 miles in length, approaching to within half a mile from the head of the loch. The lower 50-feet basin is about 8 miles in length, extending from within a quarter of a mile from the southern end as far as the entrance of the Allt a' Chairr Bhig. Separated from this lower basin by an interval of more than half a mile there is a second small 50-feet basin based upon soundings of 60, 70, and 80 feet. Proceeding up the loch from this small basin, there is an interval of nearly 3 miles before meeting with the upper 50-feet basin, which is 3½ miles in length, and approaches to within three-quarters of a mile from the head of the loch.

The lower 100-feet basin lies about 2 miles from the foot of the loch,

and is about 2 miles in length; the maximum depth recorded in this basin was 140 feet, observed in two different places. Separated from this lower basin by an interval of $1\frac{1}{2}$ miles lies the central 100-feet basin, enclosing the deepest part of the loch, which is about 2 miles in length. The remaining two small 100-feet basins are situated towards the head of the loch, the larger, distant about $1\frac{1}{2}$ miles from the head, being 1 mile in length, and having a maximum depth of 129 feet, separated by an interval of half a mile from the smaller, based upon soundings of 104, 106, and 108 feet. Within the central 100-feet basin above mentioned the bottom sinks in two places below the depth of 150 feet—(1) at the south-eastern end of the 100-feet basin, where soundings of 156 and 157 feet were recorded; and (2) about half a mile further up the loch and towards the north-eastern shore, where the deepest sounding in the loch (162 feet) was taken—apparently a deep hole surrounded by much shallower water.

The alluvial cone at the mouth of the river Fiodhaig has already been referred to, and here shallow water extends right across the loch, cutting it into two deeper portions. The land has been cut into a delta-shaped form at the head of the loch, where the river from Loch a' Ghriama flows into Loch Shin.

Temperature Observations.—Numerous surface temperatures were taken during the week spent on the survey of Loch Shin, the readings ranging from 56·0° Fahr. to 59·0° (the air-temperature during the same period ranging from 52·6° to 63·0°).

Loch Merkland.—Loch Merkland lies about three miles to the north of the head of Loch Shin, amid beautiful surroundings, Ben Hee rising to a height of 2864 feet on the north-east, with Carn Dearg (2613 feet) and other heights to the north, and Ben Leoid (2579 feet) to the west. It trends in a north-north-west and south-south-east direction, and is three miles in length, with a maximum breadth of over one-third of a mile, the mean breadth being a quarter of a mile. Its waters cover an area of about 440 acres, or two-thirds of a square mile, and it drains an area of about sixteen square miles. Nearly one hundred and twenty soundings were taken, the maximum depth of 85 feet having been observed close to the narrows towards the head of the loch. The volume of water is estimated at 577 million cubic feet, and the mean depth at over 30 feet. The loch was surveyed on September 2, 1902, when the elevation of the lake-surface above the sea was found to be 360·2 feet.

Loch Merkland is comparatively simple in conformation; the deeper water occurs towards the head of the loch, and is cut into two portions by a shoaling of the bottom at the narrow portion where the large alluvial cone laid down at the mouth of the Allt nan Allbannach on the north-eastern shore approaches the smaller cone at the mouth of the Garbh Allt on the opposite shore. The depth of the channel at the narrows referred to is 31 feet, and the 10-feet and 25-feet basins extend from end to end, roughly approximating with the outline of the loch. The principal 50-feet basin extends from the narrows for a distance of

three-quarters of a mile down the loch, and there is an isolated sounding of 52 feet to the north-west of the narrows. The 75-feet basin is a long and narrow area, half a mile in length, the deepest sounding having been recorded at the upper end of this basin, and comparatively close to the south-western shore, off which the slope is steep.

Loch a' Ghriama.—Loch a' Ghriama (or Griam) lies immediately to the north of the head of Loch Shin, into which its waters are carried by a short rapid stream. The distance between the two lochs is only a quarter of a mile, and at the time of the survey there was a difference in level of nearly 33 feet. It is a good trout loch, and *Salmo ferox* is also found in it. The principal feeder is the Amhainn an Ceardaich, over a mile in length, bearing the outflow from Loch Merkland. It trends almost north and south, and is $1\frac{1}{2}$ miles in length, nearly uniform in width, the maximum breadth being over a third of a mile, and the mean breadth over a quarter of a mile. Its waters cover an area of about 260 acres, and it drains directly an area of over $6\frac{1}{2}$ square miles; but since it receives the outflow from Loch Merkland, its total drainage area is over $22\frac{1}{2}$ square miles—an area fifty-seven times greater than that of the loch. The maximum depth of 64 feet was observed approximately in the centre of the loch, but rather nearer the northern than the southern end. The volume of water is estimated at 314 million cubic feet, and the mean depth at 28 feet. The loch was surveyed on September 1, 1902, when the elevation of the lake-surface above the sea was found to be 303·7 feet, which is almost identical with the elevation observed by the Ordnance Survey officers on July 4, 1856, viz., 303·5 feet.

The conformation of Loch a' Ghriama is simple, with one or two very slight undulations of the lake-floor, the principal of which gives rise to a striking sinuosity in the 50-feet contour; otherwise the contour-lines coincide approximately with the outline of the loch. The 25-feet basin is about $1\frac{1}{4}$ miles, and the 50-feet basin over half a mile, in length.

Loch Fiodhaig.—Loch Fiodhaig (or Fiodiag or Fiag) lies to the north-east of the head of Loch Shin, into which its superfluent waters are carried by the river Fiodhaig (or Fiag). This is a good trout loch, but the fishing is preserved, surrounded by moorland hills, with Ben Hee rising to the north. It receives the outflow from Loch a' Ghorm-Choire and another smaller loch lying to the north, which were not sounded. The loch trends in a north-and-south direction, and is over $1\frac{1}{2}$ miles in length, with a maximum breadth near the northern end of two-thirds of a mile. Its waters cover an area of about 370 acres, or over half a square mile, and an area of twenty times greater—an area of over $11\frac{1}{2}$ square miles—drains into it. The maximum depth of 71 feet was observed not far from the largest island in the loch, and nearer the northern than the southern end. The volume of water is estimated at 415 million cubic feet, and the mean depth at nearly 26 feet. Loch Fiodhaig was surveyed on October 23, 1902, but the elevation above the sea was not determined by levelling; judging from the contour-lines, the lake-surface is apparently nearly 700 feet above sea-level. The loch is

irregular both in outline and conformation. The lake-floor shows undulations, and in some places deep water approaches very close to the shore.

The temperature of the surface-water on the date of the survey was 48·0° Fahr. (the air-temperature being 51°).

Gorm Loch Mòr.—Gorm Loch Mòr lies about four miles to the west of the head of Loch Shin, in a mountainous district, with Beinn Leoid (2597 feet) to the north, Beinn Uidhe (2384 feet) to the west, and Ben More Assynt (3273 feet), and Coniveall (3234 feet) to the south. Its outflow is carried through a series of smaller lochs (Fionn Loch Mòr, Fionn Loch Beag, and Loch na Sroine Luime), which could not be sounded, into the river Cassley. Though a comparatively small loch, it has the distinction of being deeper than the other lochs in the basin, except Loch Shin. It is very irregular in outline, and includes many islands. The length of the loch, along a straight line from north-west to south-east, is slightly over a mile; but along a line following the deeper water it is considerably more. The greatest width in a north-and-south direction is over half a mile, the mean breadth of the entire loch being less than a quarter of a mile. Its waters cover an area of about 185 acres, or over a quarter of a square mile, and it drains an area of 5¼ square miles. Nearly seventy soundings were taken, the maximum depth of 91 feet being observed comparatively close to the western shore. The volume of water is estimated at 196 million cubic feet, and the mean depth at over 24 feet. The loch was surveyed on October 22, 1902, when the elevation of the lake surface was found to be 837 feet above the sea; when visited by the Ordnance Survey officers on October 1, 1870, the elevation was 846·4 feet above sea-level.

The floor of Gorm Loch Mòr is most irregular, islands and banks and deep soundings being found here and there in close proximity, while in other places deep water approaches close to the shore. The contour-lines are of the most sinuous description, with isolated deep and shallow patches. The deepest part of the loch runs along the western shore, off which the slope is uniformly rather steep, and occurs towards the north-western end.

Temperature Observations.—A surface reading at 10 A.M. on October 22, 1902, when commencing the survey, gave 44° Fahr., but at 2 P.M. in the deepest part of the loch a series of temperatures gave identical readings, viz. 46·2° at the surface, and at 10, 25, 50, and 75 feet.

Loch Ailsh.—Loch Ailsh lies about 10 miles to the west of Loch Shin, with the heights of Ben More Assynt and Coniveall rising to the north. It is a moderate-sized but rather shallow loch, containing trout and an occasional salmon or grilse. It is irregular in outline, slightly under a mile in length from north to south, with a maximum width in the northern portion exceeding half a mile. Its waters cover an area of about 245 acres, and it drains an area forty-four times greater—an area of nearly 17 square miles. The maximum depth of 24 feet was observed in the north-eastern part of the loch, less than a quarter of a mile from the alluvial cone laid down at the mouth

of the river Oykell on the northern shore. The volume of water is estimated at 88 million cubic feet, and the mean depth at 8⅓ feet. The loch was surveyed on September 6, 1902, when the elevation of the lake-surface above the sea was found to be 498·5, almost identical with that observed by the Ordnance Survey officers on August 29, 1871, viz. 498·4 feet. The highest drift-mark observed was 4 feet above the level of the water on the date of the survey. The southern and western portions of Loch Ailsh are covered by less than 10 feet of water, the deeper part lying along the eastern shore and towards the north-eastern angle of the loch. The area of the lake-floor covered by less than 10 feet of water is about 173 acres, or 71 per cent. of the entire area, while that covered by more than 20 feet of water is only about 12 acres, or 5 per cent. The temperature of the surface water at 2 P.M. on the date of the survey was 55·3° Fahr., and a reading at a depth of 20 feet gave 54°.

Loch Craggie.—Loch Craggie is a small but rather deep loch, less than 3 miles to the south of Loch Ailsh, the road from Oykell Bridge to Lochinver running along the northern shore. It trends in a north-west and south-east direction, is nearly two-thirds of a mile in length, and covers an area of about 45 acres. The maximum depth of 40 feet was observed approximately in the centre of the loch. The volume of water is estimated at 30 million cubic feet, and the mean depth at 15⅓ feet. It was surveyed on September 23, 1902, when the elevation of the lake-surface was found to be 505·95 feet above the sea; when visited by the Ordnance Survey officers on August 26, 1871, the elevation was 506·5 feet above sea-level.

Loch Craggie is quite simple in conformation. The water is deep close to the shore all round, except towards the outflow at the south-east end, the area of the lake-floor covered by less than 10 feet of water being only about 15 acres, or 34 per cent. of the entire area; more than half of the bottom is covered by water between 10 and 25 feet in depth, while about 6 acres, or 13 per cent., are covered by more than 25 feet of water. Temperature observations taken at 3·30 P.M. on the date of the survey showed that the water was practically uniform in temperature from surface to bottom, the reading at the surface being 52·8° Fahr., and at the depths of 15 and 30 feet, 52·5°.

Loch an Daimh.—Loch an Daimh (or Damph) is situated about 7 miles to the south-west of Oykell Bridge, and about 8 miles to the east of Ullapool on Loch Broom. Though at present in the eastern watershed, the day may not be far distant when it will be diverted to the west, for the small stream flowing into the Rhidorroch river is cutting back rapidly, is much lower than the loch, and will probably tap the loch at the south-west end. The shores rise well above the loch, and the south-eastern shore is wooded; it is a good trout loch, but the fishing is preserved. Loch an Daimh is a narrow loch trending south-west and north-east, nearly 1¾ miles in length, with a maximum breadth of only one-fifth of a mile. Its waters cover an area of about

173 acres, or a quarter of a square mile, and it drains an area of about 2½ square miles. The maximum depth of 52 feet was observed approximately near the centre of the loch, but towards the south-west end. The volume of water is estimated at 205 million cubic feet, and the mean depth at over 27 feet. The loch was surveyed on August 23 and 25, 1902, when the elevation of the lake-surface was found to be 671·5 feet above the sea—identical with the elevation observed by the Ordnance Survey officers on August 1, 1870; during the winter of 1901-2 the water rose 2 to 3 feet.

Loch an Daimh is extremely simple in conformation, with no pronounced irregularities of the lake-floor. The 10-feet and 25-feet basins extend from end to end, and the 50-feet basin, half a mile in length, occupies a central position.

The surface temperature on August 23, 1902, at 12.30 P.M., was 57° Fahr.; and on August 25, at 11.45 A.M., 56°.

Loch Migdale.—Loch Migdale is situated close to the northern shore of the Dornoch firth, and less than a mile from Bonar Bridge at the head of that firth. It contains trout and pike, and the surrounding scenery is very fine, a conspicuous hill called Migdale Rock rising off the north-eastern shore. The island at the west end of the loch is artificial, composed of large and small stones; a crossing passes from the western shore to the island, and was covered by a foot of water at the time of the survey. The loch trends in a north-west and south-east direction, and is nearly 2 miles in length, with a maximum width of nearly half a mile towards the north-west end, the loch narrowing gradually towards the opposite end. Its waters cover an area of about 260 acres, and it drains an area of about 7¼ square miles. The maximum depth of 49 feet was observed rather nearer the north-west than the south-east end. The volume of water is estimated at 242 million cubic feet, and the mean depth at over 21 feet. Loch Migdale was surveyed on September 24, 1902, when the elevation of the lake-surface was found to be 113·6 feet above the sea; when visited by the Ordnance Survey officers on November 1, 1869, the elevation was 115·1 feet above sea-level.

The loch forms a simple basin, with a few minor undulations of the lake-floor. The contour-lines approach nearer to the eastern end, where the Spinningdale burn flows out, the water being shallower towards the opposite end, with weeds growing off the northern shore, at the entrances of Migdale burn and Munroe's burn. The area of the lake-floor covered by less than 10 feet of water is about 70 acres, or 27 per cent. of the total area, while that covered by more than 25 feet of water is about 94 acres, or 36 per cent. Temperatures taken at 6 P.M. on the date of the survey, in the deepest part of the loch, showed very little variation in the temperature of the water, the reading at the surface being 54·9° Fahr., at 25 feet 54·1°, and at 40 feet 54°.

Loch an Lagain.—Loch an Lagain (or Laggan) lies about 3½ miles to the north-east of Bonar Bridge. It receives the outflow from Loch

Laro (which was not sounded), and its superfluent waters are carried by the river Evelix, after a long winding course, into the Dornoch firth. It is a small, comparatively shallow loch, trending almost east and west, one mile in length, with a maximum width towards the western end of nearly a quarter of a mile, narrowing gradually towards the eastern end. Its waters cover an area of about 68 acres, and it drains a relatively large tract of country, the area of which exceeds 8 square miles—an area seventy-four times greater than that of the loch. The maximum depth of 18 feet was observed near the centre of the loch, but towards the northern shore. The volume of water is estimated at 23 million cubic feet, and the mean depth at $7\frac{1}{2}$ feet. The loch was surveyed on September 25, 1902, but the elevation of the lake-surface above the sea could not be determined; the Ordnance Survey officers levelled the loch on November 23, 1869, and found the elevation to be 446·2 feet above sea-level. The lake-floor is quite simple in conformation, with no irregularities, the deeper water approaching nearer to the eastern than to the western end; the area covered by less than 10 feet of water is about 49 acres, or 71 per cent. of the total area of the loch. The temperature of the surface water was 53·0° Fahr., and a reading at a depth of 9 feet gave 52·9°.

Loch Buidhe.—Loch Buidhe (or Buie) lies amid moorland hills about five miles to the north-east of Bonar Bridge, the road from that place to Golspie running along its southern shore. It receives the outflow from Lochs Cracail Mor and Cracail Beag (which were not sounded), and flows, as already stated, into the head of Loch Fleet. It is a good trout loch, but an attempt to introduce salmon failed. The loch trends east and west, and is $1\frac{1}{4}$ miles in length, with a maximum breadth of nearly a quarter of a mile. Its waters cover an area of about 133 acres, and it drains an area of about $8\frac{3}{4}$ square miles—an area over forty times greater than that of the loch. The maximum depth of 36 feet was observed approximately in the centre of the loch. The volume of water is estimated at 68 million cubic feet, and the mean depth at $11\frac{3}{4}$ feet. The loch was surveyed on September 25, 1902, when the elevation of the lake-surface above the sea was found to be 528·45 feet; when visited by the officers of the Ordnance Survey on May 21, 1870, the elevation was 527·3 feet above sea-level. By means of the sluice at the east end of the loch the level of the water may be raised 4 or 5 feet, but it is seldom, or never, used; according to the keeper, the water may fall 2 feet below the level on the date of the survey.

Loch Buidhe is quite simple in conformation, the bottom sinking gradually on all sides from the shore to the deepest part, which occupies a central position. The area of the lake-floor covered by less than 10 feet of water is about 66 acres, or 50 per cent. of the total area of the loch, while that covered by more than 25 feet of water is about 4 acres, or 3 per cent. Temperature observations taken in the deepest part of the loch at 1·30 P.M. on the date of the survey showed little variation, the reading at the surface being 52·6° Fahr., at 20 feet 52·1°, and at 30 feet 52·0°.

NOTES ON THE GEOLOGY OF THE SHIN BASIN.

By B. N. Peach, LL.D., F.R.S., and J. Horne, LL.D., F.R.S.

Of the area included in the basin of the Shin, only narrow belts along the west, north, and east margins have been mapped by the Geological Survey. The greater part of the tract is occupied by crystalline schists of the types so largely developed in the counties of Sutherland and Ross, to the east of the line of complication which stretches southwards from Loch Eireboll by the headwaters of the Cassley and the Oykell rivers to Ullapool. The course of the Moine thrust—the most easterly of the great Post-Cambrian displacements described in the "Notes on the Geology of the Assynt District,"[1] runs south from Gorm Loch Mòr by Loch Ailsh to near Loch Craggie, thence it curves westwards to Knockan beyond the limits of the Shin basin. East of this dislocation, the metamorphic rocks include quartz schists, quartz-biotite-granulites, garnetiferous muscovite-biotite schists and flaggy micaceous gneisses. These are pierced by igneous materials (granite and diorite) that cover considerable areas, as near Lairg.

Along the eastern part of the basin there is a belt of Old Red Sandstone strata running in a north-east and south-west direction, its western limit being approximately defined by a line drawn from the Mound station to a point west of Edderton station. Both the middle or Orcadian and the upper divisions of this formation are represented, the latter occurring between Tain and Tarbat Ness and northwards along the shore by Dornoch.

Gorm Loch Mòr.—This lake, situated in the high plateau east of Ben More, lies in a rock basin formed mainly of Cambrian quartzite. Part of the floor, where the Garbh Allt enters the loch, may be composed of thrust Lewisian gneiss underlying these quartzites. The deepest sounding is 91 feet, and at the outlet the water flows over ledges of the higher or "pipe-rock" zone of the quartzite. Around the lake, the traces of glaciation are extremely abundant. Both the striæ and the disposition of the carried boulders prove that, during the greatest extension of the later glaciers, the ice radiating from the east side of the Ben More range crossed the ridge in a north-east direction beyond Gorm Loch Mòr and overflowed into Loch Shin. At a later stage, the glacier that issued from Coire a' Mhadaidh curved round Cailleach an t-Sniomha on the west side of Gorm Loch Mòr, and moved north-west by Glen Beg to the head of Loch Glencoul. The quartzite plateau in the east part of the lake is dotted over with moraines, which there form the islands.

Loch Ailsh is a shallow lake—the greatest depth being 24 feet—partly enveloped in drift and solid rock. It rests on various zones of Cambrian age, including the quartzite, Fucoid beds, serpulite grit, and limestone with intrusive igneous materials, all overlying the Ben More thrust-plane. From the covering of drift, it is uncertain whether this lake is a true rock basin. Its surface level is 498·5 feet, and the rock first appears at the outlet at a height of 490 feet above Ordnance datum line.

Loch Craggie is a true rock basin, the deepest sounding being 40 feet. The rocky barrier is formed by siliceous schists and mica-schists that are well exposed in the stream below the outlet and by the side of the road along the north bank of the lake. The height of the surface of the water above sea-level is 505·95 feet, and that of the solid rock where the bridge spans the Craggie burn below the

[1] See *S.G.M.*, vol. xx. p. 235, May 1904.

outlet is 505 feet. The direction of the ice-movement during the later glaciation was parallel with the long axis of the lake.

Loch an Daimh lies along a line of dislocation or fault that has been traced for a long distance in the crystalline schists south-westwards towards the head of Loch Broom. In the streams draining the hill slope on the northmost side the strata are exposed, which there consist of quartzose granulites with intercalations of mica-schist. On the higher part of the declivity the beds dip at gentle angles to the south-east, but on approaching the lake they are thrown into rapid folds parallel with its long axis, and are much crushed and shattered. At its lower end the lake is invaded by cones of alluvium brought down by the streams on either side.

NOTES ON THE BIOLOGY OF THE LOCHS OF THE SHIN BASIN.

By James Murray.

Collections of plankton were made in eight lochs of the basin. The lochs are mainly characterised by the presence of two northern species of *Diaptomus* (*D. laciniatus* and *D. laticeps*), besides the common *D. gracilis*, and by the very numerous Desmids, many of which are of the western type.

Each of the three species of *Diaptomus* was found in five lochs—*D. gracilis* in Lochs Shin, a' Ghriama, Ailsh, Gorm Loch Mòr, and Fiodhaig; *D. laciniatus* in Lochs Shin, a' Ghriama, Merkland, Ailsh, and an Daimh; *D. laticeps* (or a related species) in Lochs a' Ghriama, Ailsh, an Daimh, Gorm Loch Mòr, and Fiodhaig. All three species occurred together only in two lochs, a' Ghriama and Ailsh, while in all the other lochs, except Merkland and an Lagain, there were two species; in Loch Merkland *D. laciniatus* was the only species seen. *D. laticeps* was identified in Lochs a' Ghriama and Ailsh; in Lochs an Daimh, Gorm Loch Mòr, and Fiodhaig, a species of the same group occurred, but as only females or immature males were seen, it is not certain whether they were *D. laticeps* or the very closely related *D. wierzejskii*.

Among other Crustacea there is little to note—*Holopedium* was only seen in Lochs Shin and a' Ghriama; *Leptodora* in Lochs Shin, a' Ghriama, and an Daimh; *Sida* in Loch a' Ghriama only: *Diaphanosoma* in nearly all of the lochs. Nearly all the *Daphniæ* of Loch Fiodhaig were males.

Ilyocryptus acutifrons, G. O. Sars, was found in Loch Shin in August 1903, being previously unrecorded for Great Britain. It was obtained in a shallow bay at the mouth of the Fiodhaig river.

The Desmids of Loch Shin have been fully studied by Messrs. W. and G. S. West.[1] On the occasion of our visit the very great abundance, of individuals as well as species, was remarkable, exceeding anything that we had observed in other lochs. In Lochs a' Ghriama and Merkland the species were also very numerous, and, on the whole, the same as in Loch Shin. In Lochs Ailsh, an Daimh, and an Lagain, few Desmids were seen, but all had some of the western species. In Gorm Loch Mòr and Loch Fiodhaig no Desmids were noted.

Pelagic Rotifera were abundant only in Lochs Shin, a' Ghriama, and Ailsh; in Loch Shin the plankton collections also included many littoral species, which must have been driven out by the stormy weather. *Floscularia pelagica*, Rousselet, was in Loch a' Griamha only. Skeletons of the Heliozoan, *Clathrulina elegans*, were abundant in Lochs Shin and a' Ghriama.

[1] See *Journ. Linn. Soc., Bot.*, vol. xxxv. p. 519, 1903.

MALTA: NOTES ON A RECENT VISIT.

By Ralph Richardson.

The visitor to Malta finds he must get rid of several prejudices. He had probably imagined it to be a rather unattractive and unimportant island, whose chief town, Valletta, was remarkable for its endless stairs, its squalid population, and its insufferable smells. Whatever old-fashioned Valletta may have been, modern Valletta has totally changed for the better. It is a fine, stone-built city, with several broad level streets, excellent shops and hotels, handsome buildings, widely-spreading suburbs, electric tramways and motor omnibuses, and a general appearance of prosperity. To ascend from the level of the harbour to that of the residential quarter a huge Lift is in constant requisition. The streets of the city are clean, well kept, and well lighted, and the population is quiet, sober, well-dressed, industrious and polite. A Tunis resident informed me that the Maltese there are much better and quieter people than the Sicilians. The census of 1901 showed that there were over 12,000 Maltese and over 67,000 Sicilians in Tunisia. These immigrants assure the prosperity of that flourishing French colony.

Everywhere throughout Malta one finds signs of industry, sobriety, and prosperity. The soil of the island is laboured to a degree seldom seen elsewhere, and is cultivated in small fields surrounded by lofty drystone walls. There is no great depth of soil, but its general quality is good, and the powerful sun, added to intensive cultivation, secures success. Specimens of the various soils are shown in the Public Library at Valletta. There is an absence of perennial streams, but the rainfall in winter is frequent and considerable.

There is only one drawback to Malta, and it is a recent one. I refer to the dreaded "Mediterranean fever," which assumes a peculiarly malignant form in Malta, although occurring elsewhere along the Mediterranean coast. So severe is it in Malta that some 600 soldiers of the garrison are annually invalided by it. When I visited Malta last May a Government Commission was sitting in Valletta, endeavouring to find the origin of this scourge. That it originates from a microbe is known, but why this microbe should have within recent years become so active and virulent in Malta has yet to be discovered. Some associate the intensity of the plague with the congested state of the population of Malta, others with the new system of drainage, but the Report of the Commission is anxiously awaited. Several previously appointed Commissions have, however, met without result, so the Maltese will not be surprised if this one also fails. The fever is a most severe one, often lasting a year and leaving bad after-effects. It affects the natives as well as the garrison of Malta, and is contagious. It has ruined Malta as a health resort. Curiously enough, it is the only serious malady known in Malta, which, if it were extirpated, would again become one of the finest health resorts in the world.

Valletta is not only a large city having, with suburbs, about 40,000 inhabitants, but it is spreading in every direction. It has a teeming population of a very temperate and orderly character, but most of its underground dwellings should be closed for sanitary reasons. In fact, the population of Malta is far too large for the area inhabited, and gives rise to some very remarkable statistics. The colony of Malta (which includes the adjacent islands of Gozo and Comino) embraces one of the most densely populated areas in the world.

On 31st March 1905 the civil population of the colony was 202,134. As the total area of the colony is 117 square miles, its population is equal to 1727 persons to the square mile; while in 1900 that of Belgium, the most densely populated country in Europe, was only 589 to the square mile, and in 1901 that of England was 436, Scotland 150, and Ireland 137.

At the same time, it must be admitted that the general health of Malta is good. Nowhere can be seen more healthy-looking men, women, and children, and as long as Britain keeps large naval and military forces there, so long will work and food be found for a very considerable population. The Maltese are a strongly built, swarthy race, of height less than the British average, but capable of much endurance which their frugal and sober habits undoubtedly account for.

Great public works have been erected of late years—extensive barracks, hospitals, schools, and harbour works—and an immense breakwater is in course of construction at Valletta, which will make its splendid Grand Harbour more secure from storms than it ever yet has been. Owing to rough weather during last winter, its erection by Messrs. Pearson (who are also building Dover Breakwater) has been an arduous achievement.

The island of Malta is 17½ miles in length and 8½ miles in breadth, with an area of 95 square miles. Its earliest settlers were Phœnicians, and some have derived the name from the Hebrew (Phœnician) *Malet*, signifying "refuge" or "asylum," which, on account of the fine honey produced in the island, was turned by the Greeks into *Melita*, which the Arabs corrupted into *Malta*. The neighbouring islands of Gozo and Comino extend to 22 square miles, giving the whole British colony an area of 117 square miles.

The latest and best account of Malta is probably by that elegant and well-known writer, M. René Bazin, de l'Académie Française, in his *Sicile*, where he describes a visit to Malta, in the course of which he hints that if the British left Malta there would soon be no signs that they had ever been there at all. This may be true as far as the Maltese are concerned, who will probably go on speaking Maltese for an unlimited period; just as the Alsatians continued to speak German after 222 years of French rule. At the same time there will always continue to exist in every part of Malta imperishable monuments of British energy, expenditure, and skill. Like those of the ancient Romans, their works will remain for ever. The fortifications of Malta have been greatly improved and strengthened, and seem destined to make British sovereignty perpetual, provided Britain retains command of the

sea; for, owing to its excessive population, Malta could be starved out in a few weeks by a blockading fleet. There are, however, large military granaries, and the supply of water from the western heights of the island to Valletta is abundant in quantity and excellent in quality.

Although the British have held Malta since 1800, its inhabitants are only superficially Anglicised. They cling to their strange and uncouth language, which, like the Maltese place-names, is evidently of Arabic origin, rather than use English, which is now, however, being taught in all schools. Their manners and customs also are far from being English. The Maltese women wear the *faldetta*, a black hooded garment which gives them the appearance of nuns. There is a tradition that they have worn this gloomy dress ever since the excesses of the French soldiery during their occupancy of Malta, but I am informed that the *faldetta* appears in mediæval engravings.

The religious customs of the Maltese (all of whom are Roman Catholics) likewise run to extremes unknown in England or even in Europe. Priests and nuns abound, and well-attended Church services seem going on all day. Church processions and festivals are frequent, and, what will not be seen elsewhere in Europe, well-dressed men may be observed kneeling at prayer outside churches in the leading streets. It is evident that the French Revolution, which swept religious observances out of so much of Europe, never reached Malta, which remains, greatly to the tourist's satisfaction, as curious a vestige of the past as can be seen anywhere. It presents scenes such as Old France once saw, such as appear in pictures of the Ancien Régime like the background in Hogarth's "Calais Gate" in the National Gallery, London. Even the realistic Oberammergau Passion play is outdone in Malta, for on the morning of Easter Sunday public representations of Resurrection scenes are given. Men enact a race to the sepulchre between Saints Peter and John, while a third man, clad in grave-clothes, is elevated from a tomb in presence of perfectly serious crowds.

The Roman Catholic Church lost no time in annexing Malta, for it long ago conferred upon the Roman governor Publius, whose father St. Paul healed, the rank of a Bishop; and there is a remarkable painting in the beautiful modern cathedral at Citta Vecchia (the old capital of the island) representing Publius, wearing a mitre and in full episcopal vestments of modern Roman Catholic pattern, being consecrated by St. Paul, whose rugged features and peasant garb contrast with the ornate appearance of the first Bishop of Malta. This splendid cathedral of Citta Vecchia, and the great modern church of the neighbouring town of Musta, which cost £21,000, and claims to have the third largest dome in the world, attest the wealth and devotion of the Roman Catholics of Malta, many of whom gave their voluntary labour on Sundays and other festivals to assist in building the church at Musta. There seems to be a general high level of prosperity throughout the island, due doubtless to the large and constant British expenditure there.

In connection with St. Paul's celebrated visit we are apt to have formed erroneous impressions of Malta, which the Greeks called

Melita. We probably imagined from the narrative in the Acts that St. Paul was shipwrecked on an unimportant island inhabited by barbarians. Indeed the words used in The Acts (chap. xxviii., Revised Version) are: "And when we were escaped, then we knew that the island was called Melita. And the barbarians showed us no common kindness: for they kindled a fire, and received us all, because of the present rain, and because of the cold"—a proof that St. Paul's visit was during winter or spring, when the weather is often cold and rainy. Instead of Malta being a barbarous island, it had, long before St. Paul's visit, been the scene of three civilisations, the Phœnician, the Greek, and the Roman, each of which attested a by no means low state of education and often a very high knowledge of art.

Phœnician remains are found both in Malta and Gozo, the most remarkable being the Stonehenge of Malta known as Hagiar Kim (Stones of Veneration), the vast remains of a temple with its altars and enclosures, devoted no doubt to the worship of Baal, the supreme male deity of the Phœnicians, whose devotees (as shown by the sculptures in the museum at Carthage) were people of considerable artistic taste. In Gozo are the remains of a temple dedicated to Ashtaroth (Astarte), the supreme female divinity of the Phœnicians, while Greek remains have been found in both islands, which is not surprising, seeing that the south coast of Sicily, only fifty miles distant, with its once celebrated cities of Syracuse, Akragas (Girgenti), Catania, and Taormina, was for centuries peopled by Greek colonies whose temples and monuments still form one of the charms of Sicily.

With regard to the third or Roman period in Malta, many evidences are extant. A fine Roman villa has been exhumed at Citta Vecchia, which for elegance might have been occupied by Publius himself. A temple of Juno once arose in the Marsa district. The excellent museum in Valletta is full of Roman and other remains, testifying that, long before the Apostle of the Gentiles reached Malta, the island enjoyed a somewhat advanced civilisation.

In his *Table-Talk*, the poet Coleridge expressed himself strongly of opinion that St. Paul was not shipwrecked at Malta, but at the island of Meleda (also anciently termed *Melita*) in the Adriatic, off the north coast of Dalmatia, and adduced the following reasons:—1st. Meleda was in St. Paul's time a perfectly barbarous island as to its native population, whereas Malta was in St. Paul's day fully peopled and highly civilised, as we may infer from Cicero and other classical writers. Coleridge probably refers to Diodorus Siculus, a Sicilian traveller and historian, who lived in the times of Julius and Augustus Cæsar, and who speaks of the manufactures of Malta, of the wealth of its inhabitants, and of its handsome buildings. Ovid likewise alludes to it. 2nd. There are no snakes in Malta, whereas they abound in Meleda. Here, however, Coleridge made a mistake, for a friend of mine killed a snake in Malta last April, little thinking that, in doing so, he was verifying St. Paul's miracle, and saving the honour of Malta.

In Conybeare and Howson's *Life of St. Paul*, Coleridge's theory is dismissed as not corresponding with the course which the ship bearing

St. Paul is stated to have taken. These well-known authorities enter into minute particulars as to the course taken by the ship, and are convinced that that course brought it not merely to Malta, but to the very bay (the Cala di San Paolo) which has always been the traditionary scene of the shipwreck. They have even satisfied themselves that the actual "place where two seas met," and where the ship was run aground and went to pieces, was between the island of Salmonetta (at the NW. corner of St. Paul's Bay) and the mainland of Malta. An additional argument in favour of Malta is that, had the ship been wrecked in the Adriatic at Meleda, the Apostle would not have proceeded to Rome *via* Syracuse in Sicily, but *via* Ancona in Italy, which is directly opposite Meleda, and is the same distance (60 miles) from Meleda as Syracuse is from Malta.

On visiting the scene of the shipwreck, St. Paul's Bay, nine miles by an excellent road NW. from Valletta, I found the bay to be a beautiful sheet of water enclosed by a rocky coast and by the picturesque island of Salmonetta, on which a statue of the saint has been erected. The bay is a favourite place of resort of the Maltese during the summer, and seemed to me to be one of the most attractive pieces of scenery in the island.

The islands of Malta and Gozo are so severely swept by wind that the cultivators of the soil protect their crops by walls which extend all over the islands. Owing to the high winds (often utilised to turn windmills) trees are exceedingly rare, the best being in the gardens attached to the Governor's summer residence at Sant' Antonio. This absence of trees and immense number of walls give Malta a stony appearance which detracts from its beauty, while the glare from the prevalent white stone and roads is trying for the eyes. Mules and donkeys are much employed. Animals are well cared for, and the excellent horses used by the Maltese cabdrivers would put to shame many Parisian hacks. Owing to the absence of grazing, Malta is dependent for milk on goats or milk-sheep.

With regard to the character and habits of the Maltese, I am informed by those who know them well that, while good and gentle, they lack the best qualities of the British working classes. They are, however, sober, cleanly, and industrious. They are accustomed to so many religious festivals that their working time is much encroached on, and they do not, as workers, possess much thoroughness. They have, like the Corsicans, an exalted opinion of their island, but certainly seem to think better of the British than the Corsicans do of the French. A few years ago the small minority of the population of Malta who speak Italian protested against the English language being used concurrently with the Italian in the law-courts and being taught in the schools. This section being socially influential, induced the council of the colony to refuse supplies to Government, so Mr. Chamberlain, then Colonial Minister, came to Malta to investigate the question. He found that the malcontents did not represent the people of Malta, and, with the full consent of the latter, he not only affirmed the introduction of the English language, but obtained supplies by Royal Warrant. In

their colonial policy the British have always wisely governed according to the wishes of the general body of the people of the colony, not according to those of an oligarchy, however influential.

The Maltese are fully aware that the future prosperity of their islands is absolutely dependent on Britain maintaining there a large naval and military establishment. As a matter of fact, the necessity for that vast expenditure there is at present under Imperial consideration. As long as Britain had naval and military enemies of importance in the Mediterranean she was obliged to keep at Malta a large naval and military force. But she has happily no such enemies now. Italy and Britain are bound together as "hereditary friends." Austria-Hungary and Britain are on the best terms. France and Britain enjoy an *entente cordiale*. There seems to be no reason why great naval and military forces should be locked up in Malta, considering that they might be better employed elsewhere; that Malta, owing to fever, is an unhealthy station; and that, on account of its narrow limits and few resources, it is, both with sailors and soldiers, a most unpopular one. The excellent club houses of Malta, however, mitigate to some extent the officers' *ennui*, for none better could be found anywhere than the Union Club at Valletta, the Sporting Club at Marsa, or the Seaside Club at Sliema.

The geology of Malta has been fully described, with an excellent geological map, in Sir John Murray's paper which was published in this *Magazine* for September 1890 (vol. vi. p. 449), and is probably the most important contribution on the subject which has yet appeared. The leading building stone is a very soft white limestone belonging to a Tertiary series, which Sir John Murray designates "Globigerina Limestones," and he adds that, owing to their power of absorption, we may "readily believe that the foundations of Valletta and other towns situated on the Globigerina Limestones are saturated with the sewage of centuries." This limestone is capable of being cut with the greatest ease, and is soon affected by the weather, but its economical and expeditious working enables houses to be very rapidly built. It has a fine white appearance, and resembles the stone that is used for building in Paris.

Numerous elephant remains have been found in Malta, and attest the junction of the island at one time with Africa, from which (although 180 miles distant) it is divided by a relatively shallow sea-basin. It was also united with Sicily, the depth of the sea between the two islands, the so-called "Malta Canal," being very small, and the soft white limestone already referred to occurring in both islands. "Many of the microscopic sections," says Sir John Murray, "of the Globigerina limestone of Malta appear to me to be identical with the microscopic sections of Pliocene deposits of Sicily." Specimens of the elephant remains are to be found in Valletta Museum. It may be added that the museums both at Valletta and Syracuse (in Sicily) are very creditable to both cities, being spacious, well kept, well lighted, and well arranged, and full of objects of the highest scientific and historic interest. Their officials also were obliging and well informed. The museum at Carthage likewise reflects immense credit on the Roman Catholic authorities who

formed it, and who have installed there a matchless collection of Phœnician antiquities.

The orange and lemon flourish in Malta, some of the finest oranges being produced there. The variety of lemon known as the sweet lemon is likewise common, while fig-trees are plentiful, but the vine is not largely cultivated. Hedges of prickly pears and geraniums, and bushes of marguerites, attest the semi-tropical character of the vegetation. We saw barley being cut in the beginning of May, which is easily accounted for by the temperature and sunshine. My own weather notes at Valletta show that, from 5th to 10th May last, inclusive, a Fahrenheit thermometer, in the shade, registered at 9 A.M. from 65° to 69°, with daily bright sunshine. The corresponding readings for Edinburgh were 48° to 57°, with very broken weather.

With respect to maps of Malta, specimens of all the old maps are to be seen in Valletta Museum, the oldest being a quaint one representing the island as it was during Queen Elizabeth's reign. The most recent good map is one of two inches to the mile, and is now in the Society's Map Department. It was prepared in the Intelligence Division of the War Office from a map compiled in 1895.

The ancient capital of the island, Citta Vecchia, stands in the centre and highest part of Malta, and is connected by railway with Valletta, which is comparatively a modern town, owing its existence and name to the famous La Vallette, the Grand Master of the Knights of Malta, who laid the first stone of the now flourishing city on 28th March 1566. Valletta is often erroneously spelt "Valetta" in encyclopædias, atlases and other works containing geographical information. The city is situated on a lofty promontory, which stretches into the Mediterranean in a north-easterly direction, having two noble harbours to the north and south, viz. Marsamuscetto Harbour on its north side, and Grand Harbour on its south. The suburbs of Valletta are Sliema, to the north of Sliema Creek, a northerly extension of Marsamuscetto Harbour; Floriana, on the west or land side of the promontory on which Valletta stands; and Vittoriosa, Isola, and Burmola, on the south side of the Grand Harbour, all three being enclosed on the south by Cottonera Lines.

While the approaches to Valletta bristle with forts, the western or land side of the promontory is defended by two extremely strong lines of fortifications extending across the entire breadth of the promontory. Although the French surrendered Valletta in 1800 to the allied British, Maltese and Neapolitan forces, it was not till 1814 that the cession of the islands of Malta, Gozo, and Comino was confirmed to Great Britain by the seventh article of the Treaty of Paris, an event signalised by the following inscription on a tablet on the front of the Main Guard quarters in Valletta:—

MAGNAE ET INVICTAE BRITANNIAE
EUROPAE VOX ET MELITENSIUM AMOR
HAS INSULAS CONFIRMANT. 1814.

("The voice of Europe and the love of the Maltese confirm these islands to great and unconquered Britain.")

Seventeen years before the illustrious Goethe visited Sicily, a Scotsman, Patrick Brydone, F.R.S.S.L. and E., went there from Naples and ascended Etna, where he made electrical observations which won for his *Letters on a Tour through Sicily and Malta*, published at London in two vols. in 1774, considerable notice in scientific circles. He cast lustre on his native Berwickshire. His portrait by Andrew Geddes, A.R.A., is well-known from the mezzotint engraving.

In 1770 Brydone crossed in a small sailing-boat from Sicily to Malta, and his description of the island, then governed by the Knights of Malta, who policed the seas swarming with Turkish pirates, is most interesting. There is considerable resemblance between Valletta, with its numerous waterways, and Venice (although Valletta shows more signs of bustling prosperity), and the government of its Grand Masters corresponded closely to that of the Doges.

Napoleon was the destroyer both of Grand Masters and Doges, and his army acted with the same rapacity in Malta as it did in Venice. Napoleon himself set his troops an example, for, on reaching the Cathedral Church of St. John the Baptist, the patron of the Knights of Malta, and finding as its most sacred relic St. John's hand incongruously adorned with a magnificent diamond ring, Napoleon put the ring on his own finger, remarking that it would fit his finger better than it did the Baptist's bony digit.

Among the "loot" taken by Napoleon were a splendid gold-hilted rapier and dagger sent by King Philip II. of Spain to La Vallette, the Grand Master, after the great siege of 1565. The rapier is now in the Bibliothèque Nationale, Paris, and the dagger is in the Galerie d'Apollon in the Louvre. The Venetians claimed and received their bronze horses carried off by Napoleon to Paris. Ought not La Vallette's rapier and dagger to be claimed and sent back to Valletta?

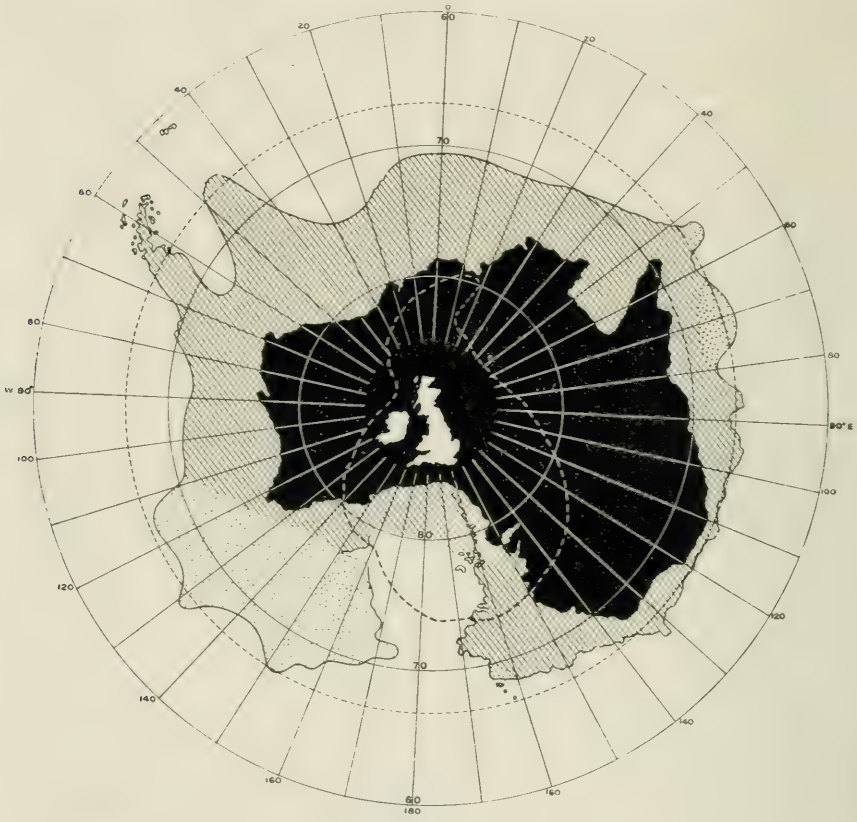
The fine Armoury of the Knights and their many imposing *Auberges* (or residences for the different "Langues" of the order, which included Knights speaking various European languages), still testify to their power, although the coats of mail prove the Knights to have been undersized men; while the Palace of their Grand Master (now the British Governor's winter residence), and the magnificent Cathedral at Valletta, give abundant proofs of their wealth and love of art. There is also an excellent Public Library, erected on a large scale during their reign, containing about 60,000 volumes in all languages.

As to ways of reaching Malta from Britain, there are two regular routes, neither very easy nor direct. There is the daily Royal Mail route through France and Italy, crossing by a Hungarian company's steamer from Syracuse, in Sicily, to Valletta in nine hours. This is a tedious and expensive route, but tourists from Sicily often visit Malta from Syracuse. The most popular route, in the opinion of Maltese residents, is by the French steamer which sails weekly from Marseilles to Tunis, and thence proceeds to Valletta. Leaving Marseilles every Monday at noon, Valletta is reached the following Thursday morning. As the steamer waits for about twelve hours at Tunis, that interesting city and the adjacent ruins of Carthage may easily be seen, but there is great delay

AREA OF UNKNOWN ANTARCTIC REGIONS

COMPARED WITH

AUSTRALIA, UNKNOWN ARCTIC REGIONS, AND BRITISH ISLES.



Scale 1:63,000,000.

in reaching Malta. It is a pity that there is no direct steamer from Marseilles to Valletta. The British Government is understood to be rearranging the Malta mail service (which it is said to subsidise to the extent of £5000 per annum), and might take the opportunity of improving the communication between Britain and Malta, and of not leaving it entirely in the hands of foreigners.

The beginning of May is probably the best time to visit Malta, for the fine weather has then set in, and the Mediterranean is usually smooth. During the winter of 1905 and the spring of 1906 broken weather was widely experienced along the Mediterranean coasts, much rain falling in Sicily and Tunisia, and Malta being constantly swept by wind and rain. The weather of Malta at the beginning of last May resembled that of the finest English summer, with a strong sun and yet a fresh atmosphere, and with a temperature ranging daily from 65° to 70° Fahrenheit in the shade.

THE AREA OF UNKNOWN ANTARCTIC REGIONS COMPARED WITH AUSTRALIA, UNKNOWN ARCTIC REGIONS, AND BRITISH ISLES.

By William S. Bruce, F.R.S.E.

(*With Map.*)

The accompanying map has been constructed to show graphically what an immense area still exists in the South Polar regions which is absolutely and entirely unknown. This is brought out by a comparison with the size of well-known land masses. The construction has been as follows. A tracing of the unknown Antarctic area was made from a large globe; that portion of the globe, on account of its size, being practically flat. Australia and the unknown North Polar area, and the British Isles, were similarly treated. These tracings having been obtained, the one was superimposed upon the other, giving the diagram now published.

By this means several striking facts are brought out. The Antarctic Continent is found by planimeter measurements to occupy the immense area of 5,470,000 square miles, an area almost equal to that of Europe and Australia put together. Thus the size of the seven different continental masses is in the following order:—

1. Asia,	17,250,000	sq. miles.
2. Africa,	11,520,000	,,
3. North America,	7,729,000	,,
4. South and Central America,	7,128,000	,,
5. Antarctica,	5,470,000	,,
6. Europe,	3,750,000	,,
7. Australia,	2,947,000	,,

The map also brings out some very interesting relationships. The fact, for instance, that Australia can be easily included within the

Antarctic land area, and yet, that an amount of land equal to the area of the Australian continent still exists almost entirely south of the Antarctic circle. It is interesting to note also that the area of the unknown North Polar regions is easily included within that of Australia. Indeed, it is less than half that of Australia, and a quarter of that of Antarctica. In addition to this enormous South Polar land mass, the interior of which is practically unknown, there exists a great unknown area of sea almost equal to the entire unknown surface of the globe round about the North Pole. An interesting comparison is also made by placing a map of the British Isles at the South Pole, to show how diminutive our native land is compared to these vast unknown regions of the globe both in the north and in the south. There is also a further comparison, the dotted outline, representing the unknown North Polar regions is, longitude for longitude, the same as the unknown Antarctic area upon which it is superimposed. It is, in fact, as if on a transparent globe the unknown Arctic area were seen through the unknown Antarctic area; by this means we see that the region most explored in the far south, viz., that on each side of the 180th meridian, is exactly the counterpart of the least explored region in the north. The following list is also useful, showing the exact proportion in square miles of the unknown area of the north and south, and of the proportion of land and water.

Antarctic Regions—Unknown land,	. .	5,470,000 sq. miles.
Unknown sea,	. .	850,000 „
Arctic Regions— Unknown sea,	. .	1,330,000 „

Thus we see that, though the unknown sea area in the Antarctic is small in comparison to the unknown land area, yet that unknown sea area is three-quarters the size of the unknown North Polar surface. Add to this the fact that, even over the so-called known regions of the sea south of 40° South, that practically nothing is known below the surface, except in those small portions traversed by the *Challenger*, *Valdivia*, *Belgica*, and *Scotia*, and we have an obviously enormous amount of work yet to be done in oceanographical science in the far south.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The following Memorial has been presented by the Society to the Secretary for Scotland:—

"1. The Royal Scottish Geographical Society was formed 28th October 1884.

"2. Its successive Presidents have been:—

1. The Earl of Rosebery.
2. The Duke of Argyll.
3. The Marquis of Lothian.
4. Sir John Murray, K.C.B., F.R.S.
5. Prof. Jas. Geikie, F.R.S.

"3. Its numbers have gradually increased until it is now the largest Scientific Society in Scotland, having nearly 2000 Members.

"4. The Society has four Centres—Edinburgh, Glasgow, Dundee, and Aberdeen, at which Lectures are regularly given from November to May. Thirty-six thousand persons attended the Society's Lectures last Session.

"5. Its Library in Edinburgh contains over 8000 books, and it receives Geographical periodicals from all parts of the world.

"6. It has a large collection of Maps and Charts, and receives the Government Ordnance Survey Maps on condition that it shows them freely to the public.

"7. It publishes *The Scottish Geographical Magazine*, a monthly Record of Geographical Exploration and Research, which is sent to its Members and to Geographical Societies throughout the world. This Magazine has been the medium for many very valuable original contributions to Geographical Science.

"8. It has assisted Exploration to various parts of the globe, and it was through its action that the Emin Pasha Relief Expedition was organised. It took a leading part in financing the Scottish National Antarctic Expedition; also an Expedition to New Guinea.

"9. It assisted the Government Ordnance Survey of Scotland in regard to Place Names, without reward, and it published the results of the Botanical and Loch Surveys of Scotland.

"10. Since May 1890 it has occupied Rooms in the Scottish National Portrait Gallery Buildings in Queen Street, Edinburgh. These Buildings were gifted to Government by a private Edinburgh Citizen.

"11. It has occupied the said Rooms under lease from the Board of Manufactures at an annual rent of £125.

"12. That lease expired on Whitsunday 1905, so that it holds its Rooms now by tacit relocation.

"13. It has repeatedly petitioned Government to remit the rent, but unsuccessfully.

"14. It stated to successive Secretaries for Scotland that the Royal Geographical Society of London received a grant of £500 annually from Government, and also the free use of a Lecture Hall, whereas the Scottish Society receives nothing. It desires a grant of £300 per annum in order to effectively carry on the work of the Society.

"15. The Departmental Committee on the Board of Manufactures reported to the Secretary for Scotland in August 1903 that the Society's rent of £125 ought to be remitted.

"16. The National Galleries of Scotland Bill, presently before Parliament, gives over all buildings to the new Board for purposes of Art, and does not recognise the existence of the Society, which might consequently be ejected from its present Rooms by the proposed Board. There is not even a clause assuring the Society of adequate accommodation in the event of ejection.

"17. The Society desires security of Tenure in its present Rooms, that its rent be remitted, and that it receive an annual grant of £300.

"18. The Society is in a sound financial condition, but its work is

much impeded by the rent it pays to Government, and by having no grant.

"19. It is unable for this reason to publish adequately important Scottish Geographical papers or to add valuable works on Geography to its library.

"20. The Society desires to have at least one representative on the Board proposed in the National Galleries of Scotland Bill, so that its interests might be attended to there.

"A deputation, consisting of the Council of the Society, laid the above Memorial, on 1st June 1906, before the Right Hon. John Sinclair, M.P., Secretary for Scotland, at his office in Edinburgh.

"JAMES GEIKIE, *President.*
RALPH RICHARDSON, } *Hon. Secretaries.*
J. G. BARTHOLOMEW, }
LACHLAN FORBES, *Secretary.*"

OBITUARY.

Dr. W. G. Blackie.—We regret to have to record the death of W. G. Blackie, Ph.D., LL.D., which took place in Glasgow on June 5. Dr. Blackie, who had reached an advanced age, was one of the first members of the Council of the Society, and took a very important part in the foundation of the Glasgow branch, of which he was at one time the Chairman. His interests were very wide, and he edited and generally supervised the issue of various geographical and scientific works, published by the firm with which he was associated.

GEOGRAPHICAL NOTES.

EUROPE.

The Recent Eruption of Vesuvius.—On May 9 Professor Giuseppe de Lorenzo, of the Mineralogical Museum in the Royal University of Naples, read a paper before the Geological Society of London on the recent eruption of Vesuvius, in which he gave a useful summary of the sequence of phenomena. He began by saying that after the great eruption of 1872 Vesuvius lapsed into repose, marked by merely solfataric phenomena, for three years. Fissuring of the cone and slight outpourings of lava began in May 1905, and continued until April 5, 1906, when the fourth great outburst from the principal crater occurred, accompanied by the formation of deeper and larger fissures in the south-eastern wall of the cone, from which a great mass of fluid and scoriaceous lava was erupted. After a pause the *maximum* outburst took place during the night of April 7 and 8, and blew 3000 feet into the air scoriæ and lapilli of lava as fragments derived from the wreckage of the cone. The south-westerly wind carried this ash to

Ottajano and San Giuseppe, which were buried under 3 feet of it, and even swept it on to the Adriatic and Montenegro. At this time the lava which reached Torre Annunziato was erupted. The decrescent phase began on April 8, but the collapse of the cone of the principal crater was accompanied by the ejection of steam and dust to a height of from 22,000 to 26,000 feet. On April 9 and 10 the wind was north-east, and the dust was carried over Torre del Greco and as far as Spain; but on April 11 the cloud was again impelled northward. The ash in the earlier eruptions was dark in colour, and made of materials derived directly from the usual type of leucotephritic magma; but later it became greyer and mixed with weathered clastic material from the cone. The great cone had an almost horizontal rim on April 13, very little higher than Monte Somma, and with a crater possibly exceeding 1300 feet in diameter; this cone was almost snow-white from the deposit of sublimates. Many deaths, Professor de Lorenzo states, were due to asphyxia, but the collapse of roofs weighted with dust was a source of much danger, as was the case in Pompeii in A.D. 79. The lava-streams surrounded trees, many of which, at the time of the lecture, still stood in the hot lava with their leaves and blossoms apparently uninjured. The sea-level during April 7 and 8 was lowered 6 inches near Pozzuoli, and as much as 12 inches near Portici, and had not returned to its former level on April 13. The *maximum* activity coincided almost exactly with full moon, and at the time the volcanoes of the Phlegræan Fields and of the islands remained in their normal condition.

Professor de Lorenzo believes that this eruption of Vesuvius is greater than any of those recorded in history with two exceptions—those of A.D. 79, the historic eruption which destroyed Pompeii and Herculaneum, and of 1631, when Torre del Greco was overwhelmed and 4000 persons perished.

A Portuguese Cartographer.—We have recently received a pamphlet on the Viscount of Santarem (*Algumas Cartas Ineditas do Visconde de Santarem*, com uma introducção e notas por Vicente Almeida D'Eca, S.S.G.L. Issued by the Socieda de Geographia de Lisboa, 1906), containing some facts of great interest. Its origin is given as follows:—At a recent Portuguese Exhibition of National Cartography, the memory of Santarem was revived by the sight of his famous atlas; and grateful allusion was made to his patriotic services. It was then found that there existed a series of letters written by him to his nephew, which had never been published; and, permission having been obtained, M. Vicente Almeida D'Eca undertook to edit them, and write a short introduction.

There does not seem to have ever been published either any biographical sketch of the Visconde, nor any critical work on his writings, and therefore the author has thought it wise to give a short outline. The author of the letters, 2nd Visconde de Santarem, was born in Portugal in 1791, and died in Paris in 1856. There was about that time a great literary revival in Portugal; due partly to the reform of

the University, to the works of the Academia Real das Sciencias, etc., but also to the policy adopted by the Marquis de Pombal and others, of encouraging the introduction of enlightened foreigners into the country. Many of these married and settled down, and their sons carried on the good work. A school of thought was thus formed, and it was in this atmosphere that Santarem was brought up. At an early stage he went to Brazil in the train of the Prince Regent, and there devoted himself so closely to the studies, for which he was afterwards famous, that we find him mentioned in 1822 by Balbi as an authority. He also was accredited to more than one European court in a diplomatic capacity. Then came the dark days for Portugal, the civil wars; and Santarem was exiled, and went to live in Paris, where his taste for letters found ample scope. We find him in full touch with the distinguished men of the day, assisting them, and contributing articles to their works, as well as studying on his own account.

The letters are all from Paris, ranging between 1839 and 1852; they are mostly written to a nephew, who was also his literary agent. They are full of intimate detail of the life he leads in Paris, of the books he reads, of the works he is bringing out. There are references to such men as Arago and Humboldt, with whom he was in correspondence. One very interesting letter we find written to Varnhagen, at that time the foremost supporter of the claims of Vespucci to be regarded as the discoverer of America. Santarem, who was a strong opponent of this theory, traverses Varnhagen's conclusions with much vigour, not hesitating to call Vespucci an impostor. There is a note in this letter which is interesting. He uses the word *Cartography*, and claims to have invented it. "I invent this word, as so many others are invented." The editor adds in a note that he has searched, but so far has found no previous instance of the use of the term cartography. The date of the letter is 8th December 1839.

The works for which the Visconde de Santarem is best known are the *Historia da Cosmographia*, *Memorias para a Historia e Theoria das Cortes*, and the *Quadro Elementar*, but the chief interest of these letters lies in the indication of the quantity of works written by him, which cannot be traced so far, and which are apparently lost. To give one instance, he mentions in letter 2 that he has prepared for the press a work which he entitles "Recherches sur la situation morale etc., du Portugal depuis les temps les plus reculés jusqu'à la fin du 14 siècle, ou examen critique des causes qui préparèrent les Portugais à entreprendre dans le 15 siècle leurs grandes expéditions maritimes." This important manuscript, the editor avers, has not been found; and yet it deals with a subject which has not been dealt with, the maritime activity of Portugal before the time of the Infante D. Henrique (Prince Henry).

The Visconde de Santarem died in Paris in 1856, and left a mass of books and manuscript behind him. A large number the editor thinks may still be in Paris. Besides, a quantity were sent to Portugal to be in the hands of Mendes Leal and Ribello da Silva, who were charged respectively with the continuation of the *Obra Diplomatica* and the *Historia da Cosmographia*. In spite of inquiries instituted, none of these

manuscripts have been found; and future investigations must take the direction of ascertaining what has become of these documents. "Would that some one," says the editor in conclusion, "might some day find these precious documents, whose loss must be a source of grief to all those who prize the name of Portugal."

The Population of Belgium.—According to *Le Mouvement Géographique* the population of Belgium shows the same tendency to accumulate in urban districts which is discernible elsewhere. On December 31, 1900, the population was 6,693,548, giving a density of 227 per square kilometre; while on December 31, 1904, it was 7,074,910, a density of 240 per square kilometre. This marked increase seems, however, to be associated with increasing concentration. Thus, comparing the total population of Brussels and its suburbs in 1881 and 1905, we find that during this period it increased from 399,833 to 609,947, and the latter figure does not include such communes as those of Uccle and Forest, which have increased enormously and have now virtually become suburbs of Brussels.

Asia.

Expedition to Eastern Turkestan.—With the approval and support of the Indian Government, Dr. M. A. Stein, Inspector-General of Education and Archæological Surveyor in the North-West Frontier Province and Baluchistan, according to the *Times*, is again on his way to Eastern Turkestan, to renew the archæological investigations which he pursued with so much success in the same region in 1900-1. The discoveries then made revealed for the first time the full extent to which Indian influence had established itself in those regions from a very early period, not merely through the spread of the Buddhist religion, but as regards language, material culture, and art. At the same time his investigations strikingly demonstrated the fact that the influence of the Classical West had penetrated even to that distant part of Central Asia during the early centuries of the Christian era. More than a year ago, under Lord Curzon's administration, the sanction of the Secretary of State for India was secured, and the Trustees of the British Museum voted a grant of £2000 towards the expenses of the expedition, which promises to be of considerable geographical, as well as of great archæological, interest. In 1900-1 Dr. Stein was able, with the assistance of a trained Indian surveyor, usefully to supplement the work of previous explorers in the Mustagh-ata region, and also to add very materially to our knowledge of a magnificent mountain region in the western section of the Kuen Lun Range. The Survey of India has again lent to him the services of the same native surveyor, Rai Ram Singh, and a number of survey instruments have been lent to Dr. Stein by the Royal Geographical Society.

Plans have been made to reach Kashgar by a very interesting route. The mission will proceed through Chitral and Mastuj to Sarhad, in Wakhan, and thence along the headwaters of the Oxus to the Tagh-

dumbash Pamir. This route runs partly through Afghan territory, and the Ameer, when approached by the Indian Foreign Department, readily accorded permission to Dr. Stein to pass across this remote corner of Afghanistan. A period of two years has been allotted for the work of the mission. Only the late autumn and winter months can be employed in excavating at desert sites, that being the period when the water difficulty can be overcome by the transport of ice.

Africa.

Ruwenzori.—Various attempts have been made this year to conquer this mountain. In the middle of January Herr Grauer, an Austrian, and two missionaries, Messrs. Maddox and Tegart, succeeded in reaching a rock on the watershed above the Mubuku Glacier at a height of about 15,000 feet. In the early part of the present year various members of the British Museum party at present in this region (cf. xxi. p. 661), made several exploring expeditions up the mountain. Thus, at the end of January, Mr. Woosnam and Mr. Carruthers repeated Herr Grauer's ascent. On February 16 Messrs. Wollaston, Woosnam, and R. E. Dent again repeated the same expedition. On the following day Messrs. Wollaston and Woosnam climbed a point on the ridge of Kiyanja about 150 feet below the highest peak, which they missed owing to fog. On April 1 Messrs. Wollaston, Woosnam, and Carruthers climbed Sir Harry Johnson's Duwoni, and found it to be 15,800 feet in height. On the 3rd they reclimbed Kiyanja, the highest crest of which they found to be 16,200 feet. These measurements were taken with an aneroid, "a very good instrument corrected to a known point at the foot of the glacier." No serious climbing obstacles seem to have been met with on any of these expeditions, but in every case mists more or less interfered with the view.

The explorers, however, saw enough to convince them that due NNW. from Kiyanja is a peak, higher than any yet attained, which they estimate at 17,000 feet. It appears to stand on a western spur a little way off the watershed. Mr. Wollaston hopes before long to investigate it more closely.

The Duke of the Abruzzi's expedition is also making good progress. On June 8 the party reached a height of 4420 metres, and from their camp there hoped to reach the summit.

Lagos and Southern Nigeria.—Mr. James Watt writes from Lagos, under date May 5, to inform us that the amalgamation of the administration of the Colony and Protectorate of Southern Nigeria has taken place. The Letters Patent and the Order in Council constituting the new Colony and Protectorate of Southern Nigeria, and the Commission appointing Sir Walter Egerton, K.C.M.G., Governor and Commander-in-Chief thereof, were promulgated on May 1st, at Lagos, the capital of the Colony and Protectorate, and at the principal towns throughout the country.

The Alexander-Gosling Expedition.—News has been received of the arrival of the Alexander-Gosling Expedition at Bima, on the river Welle, in the north of the Congo Free State, early in March of the present year. A considerable part of the final task of the expedition—the crossing of Africa from west to east—is thus already accomplished. The most interesting point as regards the journey so far, is the fact that José Lopez, the collector of the expedition, succeeded in obtaining a living specimen of the okapi, and in keeping it alive long enough for the party to make some observations on it. Captain Gosling also sends the following notes in regard to the natural habitat of the okapi, as observed by the expedition in the forests contained by the rivers Welle, Libuati, and Rubi:—

"The okapi here is generally found singly or in pairs, but Mobatti hunters state that sometimes three may be found together. An essential to the life of the okapi is a small stream of water with some muddy and swampy ground on either side. In this grows a certain large leaf that on its single stalk attains a height of 10 feet. It is the young leaf of this plant that is the favourite food of the okapi, and I venture to say that where the plant is not to be found the animal will not exist. During the night he will wander along in the mud and water in search of it. Here he may be found feeding as late as 8 A.M. in the morning, after which he retires to the seclusion of the forest, where he remains till nearly dusk. On the three occasions that I was at close quarters with the beast, he was perfectly concealed in this swamp leaf. Near the river Welle I found his spoor on ground frequented by buffalo and waterbuck, but this is unusual, and his companions in the forest are the elephant, the greater bushbuck, the yellow-backed and small red duikers. The okapi is very quick of hearing, and in that respect is classed by the Mobatti with the bushbuck. In the forest here I consider this latter beast to be more difficult to obtain than the former. On the hunting-ground of the first village that I visited, I estimated the number of okapi as five or six, at the second and third nil, and twenty miles south in the forest, on very likely ground where my guide said they were formerly numerous, there was one only, probably owing to rubber collectors who had been there. The okapi is killed occasionally by the natives, speared, shot, or trapped by the common African method. At the first village I visited, three had been speared at various times; at the second and third, one each; and in the forest referred to above, my guide had shot one."

It is stated that the expedition experienced great difficulties on their journey to Bima, and their boats had suffered severely in the rapids, but were still serviceable. The party hoped to reach the Nile in the present month.

Notes on the Vegetation of the High Atlas.—In a recent issue of the *Annales de Géographie*, M. Louis Gentil, a member of the Mission de Segonzac, gives an interesting account of the physical geography and geology of parts of Morocco, illustrated by a fine series of photographs. At the end of this paper a short account is given of two important native trees, which are both of economic and of botanical interest. One of these is the argan-tree (*Argania sideroxylon*), and the other *Callitris quadrivalvis*, the source of gum sandarach. The argan-tree has a very

limited distribution, being confined to a relatively small area at the western extremity of the chain of the High Atlas. The exact area has hitherto been stated to comprise the whole Atlantic littoral between 29° and 32° N. lat., the inland limit being about twenty kilometres from the coast, with isolated patches extending to a maximum of forty kilometres. But the author finds that the area is considerably greater than this, especially in the plain of the Sus. In the beautiful valley of the West Sus the tree extends to a distance of 150 kilometres from the coast, and rises to an altitude of 1500 metres on the southern slope of the chain, while on the north it does not stretch inland more than 45 kilometres from the shore, and scarcely rises above an altitude of 800 to 900 metres. The tree is very indifferent to the nature of the soil in which it grows, the determinating causes of its distribution being apparently a certain mean temperature and a certain state of humidity, neither of which has as yet been exactly determined.

The value of the plant may be realised when it is stated that it yields a very hard wood, that the leaves and the envelope of the fruit are much relished by domestic animals, and that the fruit kernel—rejected by ruminating animals—yields a valuable oil.

The other tree named—the *arar* of the Arabs—grows only where there is a fairly light calcareous soil, and therefore follows the outcrops of limestone rocks. The gum which it yields is of considerable value, and ultimately finds its way to London, Hamburg, and the United States.

America.

The Californian Academy of Sciences and the Earthquake.—All friends of science will regret to learn that the earthquake and fire at San Francisco have practically destroyed the whole of the valuable collections of books and specimens belonging to this Academy. An interesting article in *Science* for May 25 details the efforts of individuals to save portions of the collections. The heaviest loss is that of the whole of the reference library, which is rendered the more serious in view of the fact that there is now no reference library left in San Francisco. The Academy is facing the situation with the same courage which has been displayed by all the citizens, but the article appeals for assistance in replacing the lost books and papers:—"If scientific societies, authors, and other friends of science throughout America and abroad, will each contribute according to their ability such sets or parts of sets of proceedings, books, pamphlets, and author's separates as will be of use in a general scientific library, the aggregate will be a tremendous help towards placing the Academy once more on a working basis. In addition to books, contributions of specimens in various branches, especially in biology, will be extremely helpful. Small packages of books and specimens can be sent direct by mail. To help in this work the Smithsonian Institution, Washington, offers to receive all contributions of books or specimens for the Academy and to forward them at its own expense. . . . Packages from abroad should be marked

"Smithsonian Institution, Washington, D.C., U.S.A., c/o U.S. Collector of Customs, New York City (For Californian Academy of Sciences)."

We are glad to give publicity to this appeal as a token of sympathy for the Academy in its great misfortune.

The Southern Appalachian Forests.—We have received a beautifully illustrated report on this subject from the United States Geological Survey (*Professional Paper*, No. 37), containing some very interesting geographical facts in reference to the region named. The district comprises the two mountain chains of the Unaka and the Blue Ridge, with the intervening mountains and valleys, and has an area of approximately 10,000 square miles, the highest peak being Mount Mitchell, 6712 feet. The population is 318,000, and 24 per cent. of the area has been cleared of forest. The natural resources are chiefly the abundant water-power, as yet but little utilised, and the vast extent of forest, which has been very improperly treated. The disadvantages are the difficulties of communication and transport, and the distance from markets. As the result of their survey, Messrs. Ayres and Ashe, the authors of the report, give it as their opinion that it is in the development of the forests that the future prosperity of the region is to be sought, and that, further, if the means of communication were more fully developed, the region would more and more rise in importance as a health resort. In this connection it is interesting to note that they speak of the "economic value of the scenery"—a very modern point of view!

The forests of the regions have been injured by three main causes—the methods of lumbering, forest fires, and the clearing of the land for agriculture. The last two have been the most potent agencies of destruction, and some very striking illustrations confirm the statement that they have led to such widespread erosion that thousands of acres are as gullied and worthless as the "bad lands" of the west. The forest fires which do the most damage are the light fires which destroy seedlings and forage plants, consume the forest litter and humus, and reduce the thatch of leaves which breaks the force of the rain. On the destruction of the earth-cover the authors lay great stress. Clearing in the region, as already mentioned, is extensive, and the lands cleared are such that they are only cultivated for a few years. When first cleared the soil is fertile, and contains much humus, but owing to the steep slopes, and the destruction of the trees, the covering is rapidly eroded and swept away, and after a few years the land is abandoned as worthless, and its ruin may involve neighbouring areas. The above processes are accelerated by the fact that the land is mostly divided among small owners, and among these there is no co-operation. The authors, therefore, recommend government ownership as the only cure for the present disastrous condition of affairs. Those interested in such economic problems will find it profitable to compare the conditions in the Pyrenees (cf. p. 44), where quite another system of land tenure from that in the Appalachian region has had equally disastrous results.

The Indians of Bolivia.—A recent official publication on the

geography of Bolivia contains an interesting note on the reduction in numbers of the Indians. The race seems to be slowly but surely dying out. In 1878 drought and hunger, followed by the plague, wrought great havoc, and alcoholism is also very prevalent. It would appear that at present the birth-rate does not balance the death-rate. This gradual disappearance of the race is of considerable economic importance in view of the fact that the rearing and management of the alpaca and the llama, both animals of great importance, remains entirely in native hands, so that the question arises—will the animals die out with their masters?

Polar.

The French Antarctic Expedition.—It is announced in *La Géographie* that, owing to the wealth of material brought back by Dr. Jean Charcot's Antarctic Expedition, the French Government has undertaken to publish the results of the expedition. The Naval Department is to publish the following:—(1) Narrative of the voyage; (2) Hydrographical results, comprising nautical instructions, description, with views and photographs, of the coasts surveyed, maps and charts; (3) Astronomical observations; (4) Observations on terrestrial gravity; (5) Analyses of samples of sea-water; (6) Meteorology; (7) Terrestrial magnetism; (8) Atmospheric electricity; (9) Medical report. Further, the Department for Public Instruction is to guarantee the publication of reports on the geology, glaciology, zoology, bacteriology and botany of the expedition. The two parts will constitute one work, which will be entitled *The Cape Horn Scientific Mission*. A first part, relating to zoology, is expected to appear in a few months, and the whole will no doubt constitute a work of great geographical value.

The Mylius-Erichsen Expedition.—This expedition (cf. p. 276) left Copenhagen on June 24 for the Færöe Islands and the north, in the *Danmark*, the vessel of the expedition. The necessary funds, about 250,000 kr., have been raised partly by a Government grant and partly by private subscription. The plans of the expedition have been slightly modified, for it now appears that an attempt is to be made on the Pole itself by the East Coast in the spring of 1907. The attempt to cross the inland ice at the broadest part of the continent, which is to be made in March, April, and May 1908, is in the latest accounts more fully detailed than previously. The party making the attempt is to consist of the leader, one of the staff, and two Greenlanders, while a supporting party is to accompany them for the first third of the journey. As means of transport over the ice, the party will take ski, dog-sledges, and an automobile, which Dr. Nansen thinks can probably be used with advantage. It is hoped that the journey may be accomplished in two months and a half. From the west coast this party, if successful, will reach the southern part of the east coast again in a special vessel, and will there rejoin the *Danmark*. Motor-boats and wireless telegraphy apparatus will form a special part of the equipment.

A Glaciological Journal.—We have received the prospectus and the first part of the *Zeitschrift für Gletscherkunde*, a new journal devoted to the interests of glaciology, and edited by Dr. Edward Brückner of the University of Halle. (Published by Gebrüder Borntraeger, Berlin.) Papers in the journal are to be written in German, English, French, or Italian, and the editor is assisted by an international staff, the British representative of which is Professor James Geikie. The journal is to contain: (1) papers and treatises dealing with the whole sphere of Glaciology and the Ice Age, including the history of climate; (2) shorter articles and communications on the same subjects, including preliminary notes of expeditions, etc; (3) reviews of books and papers relating to glaciology; and finally (4) bibliography of the subject. The first issue contains an introductory note by the editor, and papers by Messrs. A. Blümcke and S. Finsterwalder, J. Geikie, P. Giradin, and P. A. Oyen, as well as a number of shorter notes. The papers are of great interest, and the whole journal promises to be of much value, and we are glad to welcome it to the ranks of geographical and geological publications. The first issue can be inspected by members at the Society's rooms. The *Zeitschrift* is to appear at irregular intervals, four or five parts constituting a volume. Not more than five parts will appear per annum.

The Prince of Monaco's Expedition to Spitzbergen.—The Prince of Monaco left Havre on June 24, on board his yacht, *Princesse Alice*, for Spitsbergen. On his way to the north he called at Granton, where he embarked a party under the direction of Mr. W. S. Bruce of the *Scotia*; thereafter he called at Tromsoe, picking up a party under Captain Isachsen of the second *Fram* Expedition. As previously stated, the Prince is intending to undertake oceanographical work to the north and west of Spitsbergen, and to do a considerable amount of high level meteorology by means of balloons and kites. Mr. Bruce's special work is to explore the island of Prince Charles Foreland, which up to the present time is almost entirely unknown, in spite of being in the track of almost every expedition that goes to the west and north of Spitsbergen. Mr. Bruce hopes to be able to make a chart at least of a considerable portion of the island; a chart in such detail that the survey will be of permanent value. He also hopes to be able to bring back some idea of the geology of the island, which is merely conjectured at, and to make zoological and botanical collections. He carries with him a good set of meteorological instruments which will give records of special value, not only as far as the island is concerned, but in relation to the meteorological work being conducted at the same time on board the *Princesse Alice*.

General.

The Meteorology of the Upper Air.—M. L. Teisserenc de Bort, Director of the Observatory for Dynamical Meteorology, Trappes, near Paris, delivered an interesting lecture under the auspices of the Royal

Society of Edinburgh, in Edinburgh recently, on "The Meteorology of the Free Atmosphere."

M. de Bort began his lecture with a brief historical retrospect, referring especially to the researches conducted, by means of kites, by A. L. Rotch in America. His own investigations had been developed chiefly from results obtained by means of sounding balloons furnished with self-registering instruments, sent up from his observatory in Paris. The lecturer made appreciative reference to the work done on mountain observatories, but pointed out that the conditions were different in the free atmosphere. For example, from kite flights made from Crinan it appeared that the temperature on the summit of the mountain was less as a rule than that of the free atmosphere at the same height. An examination of the distribution of temperature at various heights led to some quite unexpected results. Contrary to what had been thought, the difference between winter and summer was quite as well marked at a height of a few miles as near the earth. Thus, at a height of about six miles, the difference between the coldest and the hottest month of the year was fully 16 degrees Fahrenheit. It had, of course, long been known that temperature rapidly fell with increase of height, and it had been supposed that very low temperatures would be met with at an elevation of perhaps four or five miles. But so far from this being the case, the sounding balloons despatched from Trappes had enabled him to prove that, after a certain height, varying from five to nine miles, the fall of temperature ceased altogether. This stratum, where the temperature ceased to fall, had been named the "isothermal zone." The upper surface of this "isothermal" layer, as it has been called, at a height of nine miles, was the extreme limit to which observations had yet extended, and the conditions at still greater elevations were, in the meantime, matters of speculation. Again, balloon flights made daily for a week or more at a time in different years and at different seasons had shown that at intervals of a few days the upper air was subject to variations of temperature as considerable as those near the ground. Indeed, the fluctuations at a great altitude might be much more rapid than the simultaneous varyings at lower levels. For example, at a height of about six miles variations of over thirty degrees Fahrenheit were often observed at a time when variations of only three or four degrees were registered at low level stations. The distribution of the barometric pressure at various altitudes was discussed in detail. M. de Bort pointed out that areas of high and low pressure in the lower strata of the atmosphere became completely transformed at greater elevations. He had many years ago calculated the formation of the isobars over a height of between two and three miles, and his recent observations, made by means of sounding balloons, had confirmed the accuracy of his theoretical investigations.

Geographical Scholarship at Oxford.—We have received the following intimation from the University of Oxford:—

An Examination for one Geographical Scholarship of the value of £60 will be held on Thursday, October 11, 1906.

Candidates, who must have taken Honours in one of the Final Schools of the University, should send in their names to the Reader in Geography, Old Ashmolean Building, Broad Street, Oxford, not later than Monday, October 1. The Scholar elected will be required to attend the full course of instruction at the School of Geography during the academic year 1906-1907, and to enter for the University Diploma in Geography in June, 1907.

The range of the examination is indicated by the contents of the following books:—Dryer, *Lessons in Physical Geography*; George, *The Relations of Geography and History*; Mackinder, *Britain and the British Seas.*

Questions will be set giving opportunities to students of Ancient or Modern History, or of Natural Science, who have devoted special attention to the geographical aspects of their subjects.

National Congress of Geographical Societies.—We have received an intimation to the effect that the twenty-seventh National Congress of Geographical Societies will commence on July 29 at Dunkerque, and a cordial invitation has been sent to the members of the Royal Scottish Geographical Society to take part in the proceedings of the Congress, by the reading of papers and otherwise. Communications should be addressed to M. Georges Majouse, Secrétaire Général, 12, Quai de la Visite, Dunkerque, Nord.

Commercial Geography.

The Simplon Tunnel.—The official inauguration of the Simplon Tunnel by the King of Italy took place on May 19. The Royal train was drawn by two locomotives as the electric traction installation was not completed at the time of the inauguration. On May 29 and 30 other opening festivities took place, and on June 1 the tunnel was opened for general traffic.

The tunnel, it will be recollected, connects Brigue in the Rhone Valley with Iselle, and therefore with the railway to Milan at the former terminus of Domo d'Ossola, and shortens the distance from Paris to Milan by 40 miles as compared with the St. Gothard route (519 miles against 559), and by 69 miles as compared with the Mont Cenis line (588 miles).

Work on the tunnel was begun on August 1, 1898, and it was expected that it would be completed by 1904, so that there has been a delay of two years. Until the end of the autumn of 1901 rapid progress was made from both ends, but then an underground river giving 16,000 gallons per minute was unexpectedly encountered on the Italian side. This stopped the work for six months, and the difficulties experienced were at one time so great that fears were expressed that the enterprise would have to be abandoned. The difficulties were, however, overcome, and good progress was again made until the autumn of 1903. At this date, however, hot springs made their appearance on the south side, six miles from the entrance, and raised the temperature in the galleries to a very high point. Again in September,

1904, work was stopped by a similar influx of water of 1120 gallons per minute heated to 114° F. On the north side in May, 1904, similar springs were encountered with a temperature of 130° F. But in spite of all difficulties the two tunnels were successfully connected in February, 1905, elaborate arrangements for cooling the air in the galleries having been made.

An interesting scientific use of the tunnel has been made by the Swiss Geodetic Commission, who have measured directly the length of a base-line through the tunnel, extending from the Observatory of Brigue to that of Iselle. The distance is rather more than 20 kilometres, the longest base-line hitherto measured, and the undertaking is in several respects unique. The distance was measured in each direction, the total length of 40 kilometres being completed in five days of continuous work by three gangs working in eight hour shifts. Some interesting details of the undertaking will be found in the *Revue Générale des Sciences* for April 30.

The Commerce of Spain.—The *Real Sociedad Geográfica* of Madrid, in addition to the ordinary quarterly *Boletín*, publishes from time to time a review of commercial geography, under the auspices of a special section of the Society.

In a recent fasciculus, a study has been made of the commerce of Spain with other countries, the details having been drawn from consular reports and from a careful examination of mercantile journals. Each of the principal countries is taken by itself; the reader is not troubled with tables of figures, but very readable indications are given of the state of Spanish trade with each country, and emphasis very clearly placed on the points where Spain lags behind.

To give one or two examples: the export to Belgium of fruits is not at all what it should be, owing, it is said, to the absence of direct transit. Again, with regard to Norway, olive oil from Spain does not compete successfully with the French productions, in spite of the dearer price of the latter. The reason alleged is that the French oil is lighter, of better colour, and more highly refined. In short, in France more care is taken in preparation.

The trade with Morocco, in spite of the proximity of the two countries, is very disappointing, special attention being drawn to sugar and candles. Both these articles are largely produced in Spain; for them there is a great market in Morocco; and yet Spain does not compete with France, Belgium, nor England. In this connection the editor devotes considerable space to suggesting means for encouraging Spanish commerce with Tangier.

The greater part of the paper generally deals with suggestions for improving the commercial relations between Spain and Morocco, and South America; and the writer condemns in the most unsparing manner the want of energy of the Spanish exporters. A very unflattering comparison is drawn between the Spanish and German commission agents. "It is just the accommodating and unpretentious character of the German agents which has made of German industry a power which has dominated

the whole commercial world. The German manufacturer does not discuss, he obeys," and so on.

We have quoted enough to show that this department of the *Real Sociedad Geográfica* of Madrid fulfils a very useful function, and that it sets an example which is not to be despised.

The Trade of Chili.—Through the courtesy of the Chilian Consul, we have had the opportunity of seeing the statistical report of the trade of Chili for the year 1904. It gives an immense amount of information about the imports and exports, the trade with Europe and with the neighbouring States in South America. It will suffice here to give a note of the figures of the imports and export trade with Great Britain, the United States, and some of the European nations, and in doing so, we may mention that, while it is not definitely stated, we believe the standard of value to be the peso or dollar (which has the exchange value of under 1s. 6d.).

Imports.—The total imports for 1904 amounted to 157 million pesos. Of this there came from Great Britain 57 millions roughly, or 36·491 per cent., showing an increase of about 3½ millions over the previous year. Comparing this with the other chief sources of supply, one finds the following :—

Destination.	Total for 1904.	Per Cent.	Increase over 1903.
Great Britain,	57,345,488	36·491	3,625,615
Germany,	42,456,638	27·016	3,475,237
United States,	13,997,927	8·907	1,778,266
France,	10,929,907	6·955	1,561,617

Exports.—Of the total of 216 millions exported from Chili, 70½ millions had Great Britain as their destination, being 32·661 per cent. of the whole, showing an augmentation of 9 millions over 1903. Again, comparing these figures with those of the exports to certain other countries, we have the following :—

Destination.	Total for 1904.	Per Cent.	Increase.	Decrease.
Great Britain,	70,546,667	32·661	8,909,478	...
Germany,	62,632,942	28·997	20,093,120	...
United States,	30,715,150	14·220	...	2,060,522
France,	28,823,135	13·344	1,371,824	...

With regard to imports, there are one or two points worth noting. Nearly one-third of the imports from Great Britain comes, as might be expected, under the heading of textiles. In what are classed as animal and vegetable materials we are surpassed by Germany, her chief animal contributions being dried and preserved fish, and cheeses. On the other hand, one of our larger items is preserved milk of various kinds. Germany's predominance in vegetable imports is not quite so large as appears, as the imports of rice from India and of copra from Australia are given under separate headings. Still in many articles we are behindhand, as in starch, certain dyes and colouring matters, hops, etc.

Moreover, Germany sends double the quantity of chemical products and perfumery, and more explosives.

Minerals and metals form the greatest part of the exports. The largest item is saltpetre, the best customers for which are Germany and the United Kingdom. Copper is the next largest export; then the precious metals.

The Seaweed Industries of Japan.—In the *Bulletin* of the U.S.A. Bureau of Fisheries for 1904 there are two interesting articles on the utilisation or cultivation of marine and freshwater plants and animals in Japan, one of which is devoted to the seaweeds of Japan. It is of course a familiar fact that the seaweeds of Japan are very fully utilised, and form an important part of the aquatic resources of the country, but it is probably less well known that the Japanese actually cultivate the common purple laver (*Porphyra*), and find it a most profitable crop, the average yield per acre being no less than 156 dollars in 1901. The method of cultivation is simple, and consists in planting regular lines of bush with the object of intercepting the minute spores of the weed. The plants, which are annuals, are harvested in the early months of the year, the growing season being the winter months. The product —a valuable food-substance—is not only consumed locally, but is actually exported to the United States, where, on account of the large Oriental population, there is considerable demand for it. This is an interesting example of what may be called human inertia, for the whole shoreline of the United States produces purple laver abundantly. The object of the article is to point out how many of the seaweed industries of Japan could be profitably carried on in the United States. In so far as this implies a utilisation of the products as food-stuffs, a considerable preliminary education of the taste of the non-oriental public would probably be required, but it is worth note that the article states that Japan is supplanting Scotland in the world's trade in iodine, and this though Japan is a very recent competitor in this respect.

NEW BOOKS.

EUROPE.

Granada: Memories, Studies, and Impressions. By Leonard Williams. London: Heinemann, 1906.

Readers of Mr. Williams's former works on Spain will welcome another production from his pen. This is no superficial description of the country made by a passing tourist, but the impression of observations made, and of expeditions taken, which would only have been possible to one who is as conversant with the people and language as Mr. Williams is known to be. It is in no sense a guide book, and will rather appeal to those who have already been in the country, and wish to extend their knowledge of the people.

Mountaineers will read with interest the account of an ascent of the Picacho del Veleta, one of the highest peaks in the Sierra Nevada, where on the descent

the author encountered a snowstorm, and was nearly frozen to death. Mr. Williams speaks all too modestly of this adventure, for Alarcon, the well-known Andalusian writer, who in the early seventies made a literary pilgrimage through the Alpujurra, and wrote his impressions in a book strangely reminiscent of the present volume, reminds his readers that the Sierra Nevada is, with the exception of the Alps, the highest range in Europe. He gives the height of the Veleta as 12,680 feet, and he says that it is only accessible in July, and that many lives are lost in these storms. Mr. Williams made his ascent in autumn, and nearly paid the price.

There is an amusing account of one of the greatest literary frauds that ever was perpetrated. It occurred at the close of the sixteenth century, in the reign of Philip II., and engrossed the attention of all Catholic Europe. If Rome had not interfered, "the Spanish people would have embodied into the spirit and the text of the New Testament the entire contents of the leaden forgeries of the Sacred Mountain." The archbishop employed the authors of the deception to decipher the tablets!

One of the most delightful chapters deals with the Ave Maria colony just outside the town of Granada. All lovers of children will enjoy the description of the beginning and progress of this colony for waifs and strays. It was begun a dozen years ago; now it consists of six villas in the country surrounded by gardens, the whole forming a large estate. Over five hundred children are brought up there, and when they are old enough, are taught a trade. The teaching is done in the open air, in the grounds of the estate. Mr. Williams was taken to a large playground which was fashioned into a rough map of Spain. The director called up two small urchins:—

"'You, Antonio, go to Barcelona.' Antonio . . . darted across the country, planted his foot upon the haughty city of the Berenguers, and beamed at us. 'Antonio, where are you now?' 'In Barcelona.' 'Where is Barcelona?' 'In Cataluña.' 'What is there at Barcelona?' 'A university, a bishop, and half a million inhabitants.' 'What else?' 'It is a seaport, and sends out woollens and olives.' 'Now go to Madrid.' The scampering was repeated." Then another ground where they played at leap-frog, personating the Spanish monarchs the while. "'I am Philip the Fourth,' shouted a small creature, 'governed by the Count-Duke of Olivares. In my reign the Catalans rebelled against me'"!

Space does not permit of a reference to all the subjects in this charming volume, but we commend it very heartily to our readers.

Greek Life in Town and Country. By W. Miller. London: George Newnes, Limited, 1906.

This is a most interesting volume. At present, when the recent revival of the Olympic games has been recalling to our minds the glory of other days, it is almost startling to find so many of the characteristics of ancient Hellas reproduced in modern Greece. There is the same charm of manner, the same democratic spirit not without some touch of indiscipline, the same interest in politics, and above all in personal politics, which so often made the life of ancient Greek cities "oscillation without progress," the same quick temperament so easily swayed by grand, ambitious ideas, and, above all, the same distinction between the peasant population of Akarnania, Aitolia, or the Peloponnesos, and the town-bred denizens of Athens.

It is among this country population, in spite of all its ignorance and superstition, that the best qualities of the race, intellectual as well as moral and

physical, are often to be found. A striking account is given in the volume before us of the inhabitants of Máne, the central promontory of the Peloponnesos, who boast to be the descendants of the Spartans of old, and show themselves not wholly unworthy countrymen of the great Brasidas. As a rule, however, the Greek is now, as he has always been, a lover of the town, seldom anxious to exchange the excitement and delights of the city for the freshness and freedom of the country. Thus the branch of literature that finds most favour with the Greek is journalism, and, next to journalism, history.

This predominance of political interest has a double effect. The great idea of the emancipation of the now "enslaved Greece," which as the New Hellas is to include all the Balkan Peninsula, and by the possession of Crete and of Cyprus to dominate the Levant, is a vivifying and a permanent element in the national outlook. On the other hand, the politics of the hour are struggles not of principle but of intrigue, are blurred and lowered by personal questions, by lack of respect for constitutional authority and of loyalty to the Royal House, by the constant changes of Ministry which involve nearly equally constant changes in the civil and military services, and even on the judicial bench and in the class-room of the teacher.

But while the dangers that beset the Kingdom of the Hellenes are thus clearly indicated, the leading note of the book before us is one of sympathy and of confidence. It leaves us with the feeling of hope that, if all that the more sanguine dream of cannot be attained, if the Bulgarian seems likely to occupy the place in the Balkan Peninsula so long coveted by the Greek, Greece may still be free and strong and play no mean part in the civilisation of the Nearer East.

It is only to be regretted that this volume, which is so illuminating historically, should not be furnished with a map. It contains, however, a short but valuable list of recent authorities.

Rambles in Normandy, and *Rambles in Brittany*. By Francis Miltoun. With many Illustrations by Blanche M'Manus. London: Duckworth and Co., 1905. *Price 6s. net each.*

The aim of the author, an American it seems, has been to avoid competition with the formal guide-book, and he therefore devotes most of his attention to places little known to the tourist. In the Normandy volume he displays a hearty appreciation of the life of rural France, and of villages unaffected and unspoilt, and can add in this respect to the knowledge even of those who are already well acquainted with the region. Naturally, however, his personal preferences will not commend themselves to all readers. There is much general information of interest, about roads, forests, Norman idioms, social institutions, etc., and the work may usefully be read by any one who contemplates a visit to the country. The maps throughout the book are unfortunately very rough and indistinct, and the full-page illustrations are not always successful.

The *Rambles in Brittany* follows the same lines as the companion volume. We agree with the writer that Brittany is not half so well known to English-speaking folk as it should be, especially nowadays when, thanks to the Touring Club de France, the hotels have been so greatly improved, and hygienic bedrooms, etc., added, though we must lament at the same time that the charm of some places has so largely passed. One sighs to hear of bridge and ping-pong at dainty Pont-Aven. Still we read, "Nothing in Brittany is more picturesque than the little villages of"—and from one part of the book or another we may complete the sentence with quite a considerable list of names. The maps and monochrome sketches are sadly open to criticism. The view, for instance, of the alignments of

Carnac differs strangely from our recollection of them. On the other hand, we are glad to meet such a picture as "Ramparts of St. Malo."

ASIA.

The Directory and Chronicle for China, Japan, Corea, Indo-China, Straits Settlements, Malay States, Siam, Netherlands India, Borneo, The Philippines, etc. With which are incorporated The China Directory and The Hongkong Directory and Hong List for the Far East. For the Year 1906. Forty-fourth Year. Hongkong and London: The Hongkong Daily Press Office. Pp. lxiv + 1656. *Price* 30*s. net.*

The Far East has bulked largely in recent years before the public mind, and its commercial importance increases with each year. In the pages of this work of reference all who have to do with the Far East, whether as merchants or missionaries, will find a well-edited mass of accurate information which renders it indispensable. It is no mere directory. The countries and chief towns of the Far East have devoted to each of them a descriptive and statistical account. Then follows the Directory proper, which is official, educational, and mercantile. Many of these topographical articles are illustrated by plans: Batavia, Hongkong and Victoria, Kobe and Hyoge, Kowloon, Manila, Saigon, Shanghai and its Foreign Settlements, Singapore, Tientsin (Foreign Settlements), Tsin-tau, and Yokohama. Finally come a list of foreign residents in the Far East, and a list of Protestant missionaries in China, Japan and Corea. While this work is chiefly intended for business houses that have commercial relations with the Far East, it may well be commended to the notice of libraries as a valuable work of reference. The first part, which precedes the Directory and consists of nearly 500 pages, is devoted to general topics relating to the Far East, some of which are historical and others official. It begins with an Anglo-Chinese Calendar for 1906, and a calendar for 1906 with a chronology of remarkable events. The historical section gives the text of all treaties with China, Corea, Japan, Siam and Tibet. The general articles deal with rules and fees of supreme and consular courts, port and harbour regulations, customs tariffs, consular fees, chambers of commerce and scales of commission, Chinese festivals and observances, and money, weights and measures. The frontispiece is a plate giving 'house flags,' and a map of the Far East faces the beginning of the Directory proper—both of these are by Bartholomew.

At the Gates of the East. By Lieut.-Col. Barry, I.M.S. London, New York, and Bombay: Longmans, Green and Co., 1906.

The contents of this volume are a reprint of a series of letters contributed to the *Times of India* by Colonel Barry, I.M.S., the object of which was to wean "the wearied, the plethorous, and the valetudinarian from the Cult of the Spas." Dr. Barry, distrusting the generally recognised virtues of Homburg and Carlsbad, preferred to seek for a renovation of health in travelling in Greece, the Tirol, the Balkans, and the Eastern Adriatic, and he recommends to Anglo-Indians to utilise their furloughs in following his example. He is enthusiastic regarding the scenery and the people whom he met, and apparently he encountered no difficulties or dangers even in the wilds of Herzegovina, Montenegro, or Bosnia. He secured some good photographs of several of the places he saw, and with these he has illustrated the present volume. It adds nothing to our knowledge of the countries through which he passed, but it is a pleasantly written account of experiences

of, we imagine, some time ago. He recommends these tours on the ground of economy, but it is to be feared that things have much changed in this respect since these letters were first published.

Tibet and the Tibetans. By GRAHAM SANDBERG. London: Society for Promoting Christian Knowledge, 1906. *Price* 5*s.*

A mournful interest attaches to the publication of this work, for it is the last we shall ever have from the pen of one who took a high place in the ranks of Oriental scholars, and who of late years had devoted himself more particularly to the study of the language, literature, and natural history of Tibet. Mr. Sandberg, a graduate of Trinity College, Dublin, after practising a few years at the bar, took orders, and in 1886 accepted a chaplaincy in India. He was stationed for some time at Darjeeling, and there began his interest in Tibet and its inhabitants. He published several articles and handbooks on Tibet, and he supervised the publication of Sarat Chander Dass's Tibetan Dictionary. His death last March was greatly regretted by the now ever-widening circle of those who are interested in Tibet. In the brief preface written by Mr. Sandberg only a short time before his death, he states with regard to this work that the subjects mainly treated of are "the unique physical features, the geology, the botany, the zoology of the country, also the characteristics, occupations, religion, and literature of the inhabitants," and he claims that but few new facts concerning Tibet were elicited by Sir Frank Younghusband's Mission. Even the description of Lhassa in this work, which Mr. Sandberg has compiled mainly from the old secret reports of natives of the Trans-Frontier Survey of India, differs but little from the reports brought by the Mission. Be this as it may, the reader of this book will find it a treasure-house of much varied and interesting information about Tibet and its inhabitants. The author had evidently made himself thoroughly acquainted with everything that had been written about Tibet till the date of the Mission, and his difficulty has been to condense his stores of learning. The work is adapted essentially for the student rather than for the general reader.

AMERICA.

Canada As It Is. By JOHN FOSTER FRASER. London: Cassell and Company, 1905. *Price* 6*s.*

The approaching meeting of the British Medical Association at Toronto has naturally stimulated general interest in Canada, and it would be difficult to find within the compass of one volume a more instructive or suggestive guide to the Dominion than the work before us. It is written evidently from full knowledge, and, whether its views are accurate or the reverse, at least supplies much matter for thought.

Geographically it starts not from Quebec, which might seem the natural port of Canada, as being open all the year, but from Montreal, which, though ice-bound for four months, is in reality the great commercial harbour for the West. Thence the great panorama begins to unroll itself: the apple-orchards of Ontario; Lake Superior and Thunder Bay, the entrance to the great stretches of wheat-yielding prairie which, broken by rock and forest, extend between Lake Superior and Winnipeg: Winnipeg, which thirty-six years ago was represented by a fort surrounded by a wall and is now a city with a population of some eighty thousand. What was once called "The Great Lone Land" follows next; the territory of Saskatchewan, with the possibility of a direct service for a quarter of the year with Liverpool, *viâ* Fort Churchill and Hudson's

Bay; the territory of Alberta, the great ranching country, "the sirloin of Canada," which leads up to the Rockies, "not beautiful or sublime, but gaunt, foreboding, things of drear strength." The ranching country continues its vast extent on the western side of the mountains, over some two hundred millions of acres in all; and finally the traveller, breathless but not weary, reaches British Columbia, "the outpost of Empire," where West joins East, with its trees of giant size, its rivers teeming with fish, its ranges and ravines prolific in gold.

It is, however, on the political and Imperial side that the book is most suggestive. The connection between the United States and the Dominion, and the effect of the comparatively recent desire of the former for commercial reciprocity in stimulating what, for want of a better name, we call Imperialism, are clearly traced. Equally clear is the view presented to us, on the one hand, of the French Canadian who does not want a big empire, who does not care for military prowess, who only wants to be left alone; and, on the other hand, of the younger type of Canadian who does not care for Britain itself, except in a far-off, sentimental sense, but who does care a great deal for the British Empire *because Canada is a part of it.*

It is a book much to be recommended, and worthy of careful reading.

GENERAL.

Notes from My South Sea Log. By Louis Becke. T. Werner Laurie.

Mr. Becke was for many years supercargo on vessels trading in the South Seas. In this little collection of stories he has given us his recollections of the Pacific Islanders. The stories are all readable, and some are vivid and impressive. We would specially mention those that are grouped as "Shipwreck Memories," the description of nature in "The Swamp" and "The Deserted Atoll," and the introductory story, "Bay o' Fundy Days." There is an excellent map.

ANNUALS.

The Statesman's Year-Book for 1906. Edited by J. Scott Keltie, LL.D., assisted by I. P. A. Renwick, M.A., LL.B. Forty-third annual publication. Pp. 1604. London and New York: Macmillan and Co., 1906. *Price* 10*s.* 6*d. net.*

This incomparable epitome of the world's statistics has made a new departure. Its enterprising conductors have completed arrangements whereby it becomes not merely the great British authority on the vast subject of which it treats, but also the recognised American handbook. This has involved the addition of 150 pages to its contents, so as to include separate notices of the States comprised in the American Union. It has also led to the issue of two editions, a British and an American. In the former the British Empire comes first, while in the American edition the United States have first place. The editors have received information from the governors and secretaries of many of the States of the American Union, which imparts to the book an official character.

The most important events of the past year throughout the world are duly recorded, such as the dissolution of the union between Sweden and Norway, the conclusion of the Russo-Japanese war, the revolution in Russia, the mission to Tibet, the ecclesiastical changes in France, and the general election in the United Kingdom, besides the modifications of the British, French, German, and American colonies. The Navy sections of the various states have been thoroughly brought up to date. A valuable series of maps by Mr. J. G. Bartholomew illustrates (1) the economic development of the United States from 1855 to 1905;

(2) economic aspects of the United States, viz. *a*, chief mineral products; *b*, cotton and tobacco crops; *c*, production of manufactures; *d*, percentage of cultivated land; (3) the new provinces of Canada, 1905; (4) the division of Bengal, 1905; (5) the Anglo-Portuguese Barotse Boundary, 1905; (6) political changes in the Far East, 1905; (7) general distribution of the races of Russia; (8) average tariff chart, 1905.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Eleusis: Her Mysteries, Ruins, and Museum. Translated from the French of Demetrios Philios, Director of the Excavations (1882-1894). By Hamilton Gatliff. Crown 8vo. Pp. viii + 79. London: Sidney Appleton, 1906. *Price* 5*s. net.*

La Géographie à L'Ecole et les Bases d'un Système Rationnel d'Enseignement. Par Jean Bertrand, géographe. Pp. iv + 122. Bruxelles: Veuve Ferd. Larcier, Editeur, 1906.

Canada: The New Nation. A Book for the Settler, the Emigrant, and the Politician. By H. R. Whates. Cr. 8vo. Pp. xvii + 284. London: J. M. Dent and Co., 1906.

Through India with the Prince. By G. F. Abbott. Demy 8vo. Pp. x + 311. London: Edward Arnold, 1906. *Price* 12*s.* 6*d. net.*

Le Siam et les Siamois. Par Ct. E. Lunet de Lajon. Cr. 8vo. Pp. 358. Paris: Librairie Armand Colin, 1906. *Prix* 3·50 *francs.*

Through the New Commonwealth. By William Redmond, M.P. Crown 8vo. Pp. vi + 250. Dublin: Sealy, Bryers and Walker, 1906.

Felicity in France. By Constance E. Maud. Crown 8vo. Pp. iv + 331. London: William Heinemann, 1906. *Price* 6*s.*

Central Europe. By Joseph Partsch, Ph.D. With Maps and Diagrams. Demy 8vo. Pp. xiv + 358. London: Henry Frowde, 1905. *Price* 7*s.* 6*d. net.*

The Travels of Mungo Park. (Newnes' Thin Paper Classics). *Travels in the Interior Districts of Africa performed in the Years* 1795, 1796, and 1797. By Mungo Park. Size $6\frac{3}{4} \times 3\frac{7}{8}$. Pp. xxiv + 360. London: George Newnes, Ltd., 1906. *Price* 3*s.* 6*d.*

Anleitung zu Wissenschaftlichen Beobachtungen auf Reisen. Lieferung 13-15. Herausgegeben von Professor Dr. G. von Neumayer. Pp. xv + 880. Hannover: Dr. Max Jänecke, 1906. *Preis* 10*m.*

Kelly's Directory of Merchants, Manufacturers, and Shippers of the World, 1906. Twentieth Edition. London: Kelly's Directories, Ltd., 1906.

Also the following reports, etc.:—

Guide Officiel de la Navigation Intérieure: Avec Carte Itinéraire des Voies Navigables de la France. Sixième édition. Pp. iv + 597. Paris: E. Bernard, 1906.

The Official Year-Book of New South Wales, 1904-1905. By W. H. Hall. First Issue. Pp. viii + 810. Sydney: Government Statistician's Office, 1906.

Annual Report of the Department of Mines, New South Wales, for the Year 1905. Sydney, 1906.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

FROM THE ICE AGE TO THE PRESENT.

By Professor JAMES GEIKIE, F.R.S.

THERE is no general agreement amongst geologists as to where the line should be drawn between glacial and post-glacial times. Indeed any line must be arbitrary, for there is no break in the continuity of Pleistocene history: all the evidence goes to show that a regular passage obtains from the Pleistocene to the Present. It is obvious that glacial conditions must have lingered on in Scotland subsequent to their final disappearance in the south of England. We know, indeed, that long after the last-named region had been divested of perennial snow and ice, our Scottish mountains nourished considerable glaciers. From the point of view of British Historical Geology, therefore, it is misleading to apply the term *post-glacial* to deposits overlying the "chalky boulder-clay" of the Thames Valley, unless we can prove these to be contemporaneous with the superficial formations which in Scotland are clearly of later date than our youngest valley-moraines. But it is quite certain that many of the so-called "post-glacial accumulations" of Southern England are very much older than any Scottish formations so designated. If the term *post-glacial* is to be retained, therefore, it ought to be restricted to such deposits as were formed after the final disappearance of perennial snow and ice from the British Islands. But, as I shall presently show, glaciers existed in Scotland at so recent a date, that the only accumulations which can properly be described as post-glacial are those now in course of formation. The Present, in short, is the only post-glacial period we know of in Scotland. The term *post-glacial*, however, has been so long in use, and is so commonly applied to certain well-known formations in this country, that to drop it altogether might only lead to misapprehension. In this paper, therefore, I shall continue to employ it, but with a definite meaning. I shall classify as *post-glacial* all formations of later

date than that glacial stage which I have elsewhere designated as the stage of "district ice-sheets and large valley-glaciers."

If the ice-sheets just referred to marked the closing phase of the Glacial Period, we may readily recognise three stages in the glacial history of Scotland. Of these the earliest is represented by the widespread stony clay which has long been known as our "lower boulder-clay." This clay is now generally admitted to be the ground-moraine of a great ice-sheet which extended over all Scotland. Mainland and islands alike were, so to speak, obliterated by it—the pall of ice stretching south as far as the valley of the Thames. The next glacial stage is evidenced by our "upper boulder-clay"—a deposit of the same general character as its predecessor. The ice-sheet, of which this clay is the ground-moraine, did not, however, extend so far south. Nevertheless, it seems to have covered the Scottish area as completely as the earlier *mer de glace*. The succeeding stage of glaciation was much less severe; it was characterised by the presence in our mountainous areas of local ice-sheets and large valley-glaciers; the Lowlands, however, were not again overwhelmed. The three glacial stages thus briefly defined were separated from each other by prolonged epochs of genial climatic conditions; but the evidence on which that conclusion is based does not at present concern us. Suffice it to say that continued research in Europe, North America, and Asia has demonstrated that the Ice Age, so far from being one long-continued period of arctic cold, was interrupted again and again by epochs of genial climatic conditions. This remarkable cycle of climatic changes commenced before the close of Pliocene times and endured down to the very dawn of the Present. Its latest phases are represented, as I believe, by those superficial formations which have come to be known as "post-glacial accumulations." For the present, however, I shall include in the post-glacial series every formation which can be shown to be of later date than the third glacial stage as defined above.

Before considering these so-called post-glacial formations, it may be well to picture to ourselves the conditions that obtained in Scotland during the latest glacial stage—the epoch of "district ice-sheets and large valley-glaciers." At that time the Scottish Highlands and Southern Uplands were wellnigh smothered in ice. Great glaciers descended all our mountain valleys and occupied many of our sea-lochs. The land was less extensive than it is now—the sea, tenanted by an arctic fauna, reaching to 130 feet at least above its present level. Our estuaries were in winter largely frozen over, while in spring and early summer the ice, broken up into floes, often ran aground in shallow water, and confused and contorted the marine sediments accumulating there. Many erratics were by the same agency distributed over the sea-floor, and a similar transport of erratics and rock-rubbish was effected by the icebergs calved by our Highland glaciers. In the Southern Uplands very considerable ice-streams likewise existed, but none of these succeeded in reaching the sea. An arctic flora, comprising the polar willow (*Salix polaris*), dwarf birch (*Betula nana*), mountain avens (*Dryas octopetala*), and other well-marked northern forms, occupied the Lowlands; while in the fresh-water lakes *Apus glacialis* (a phyllopod now met with only in Greenland and

Spitzbergen) flourished exceedingly. This closing stage of the Ice Age is represented therefore by an abundant and varied series of deposits—by ground-moraines and terminal moraines, by fresh-water alluvia, and a well-marked beach at 100-130 feet above the present sea-level.

Amongst the more prominent formations of post-glacial age are *Raised Beaches, Moraines, Fresh-water Alluvia,* and *Peat-mosses*—the relation of which to the deposits of the preceding glacial epoch must be carefully noted. The earliest raised beach of post-glacial age occurs at a height of 45-50 feet above the present sea-level. Like its predecessor (the 100-feet beach) it is best developed in the great estuarine valleys of the Tay, the Forth, and the Clyde. Usually it assumes the form of well-marked terraces of gravel, sand, clay, and silt; but on the more open sea-coasts it is now and again represented by ledges or benches cut in the solid rock. Most of the shells, etc., it contains belong to still indigenous species.

That a long interval of time separated the formation of the 100-feet and the 50-feet raised beaches is quite apparent. Before the latter began to be formed, the arctic types of life characteristic of the older beach had disappeared from our coasts. Moreover, it can be shown that after the retreat of the arctic sea the land stood relatively higher than it does at present—in other words, Scotland in early post-glacial times extended considerably further seaward; and these geographical conditions obtained at a date long prior to the formation of the 45-50 feet beach. While Scotland thus stood at a higher elevation, the accumulations of the 100-feet beach (which then formed thick and extensive sheets, spread over the lower reaches of the great valleys of the Tay, the Forth, and the Clyde) were deeply trenched by rivers, and eventually swept away from broad tracts. The wide haughs or alluvial plains thus formed were overlooked by the bluffs of the trenched and much-denuded 100-feet beach. The climate by this time had become temperate, and thick forests eventually flourished on the alluvial flats, the dominant trees being oak, alder, hazel, birch, etc. This ancient land-surface is well preserved in the valleys of the Tay and the Earn, where it is represented by a thick layer of woody peat, from which rootlets pass downwards into the underlying fluviatile alluvia. The peat, I may add, occurs at and below the present sea-level, and is directly overlaid by the deposits of the 45-50 feet beach, which towards their base are crowded with leaves, branches, twigs, and occasional trunks of the trees just mentioned.

Obviously, therefore, the Scottish area again experienced submergence—the sea invading the land up to a height of 45-50 feet above the present coastline. In the lower reaches of the Tay Valley the carse-deposits belonging to this epoch consist largely of laminated clay and silt. As they are traced up the valley, however, they gradually become more and more arenaceous, until eventually they merge into ordinary river-alluvia, the materials of which become increasingly coarser as they approach the mountains.

It is evident, then, that the passage from glacial to post-glacial times was marked by the retreat of the sea and the appearance of a wider land-area than now obtains. And this geographical change was accom-

panied by a decided amelioration of climate. Subsequently, the land again subsided, and there is strong evidence to show that this movement was accompanied or followed by a relapse to cold conditions. At the head of Loch Torridon, for example, well-formed terminal moraines rest directly upon the 45-50 feet beach. To this positive evidence may be added certain negative evidence. The 45-50 feet beach not infrequently fails to appear at the heads of certain sea-lochs in the North-West Highlands, although it may be well-developed in their lower reaches. Either, therefore, glaciers at that time occupied the heads of the fiords in question and thus prevented the formation of a beach; or the beach, having been formed before the glaciers reached the coast, may have been subsequently destroyed by those glaciers when they advanced into the sea.

That Neolithic man lived in Scotland in early post-glacial times is proved by the frequent occurrence of his relics in the deposits of the 45-50 feet beach. At Perth, for example, a dug-out canoe of pine was met with towards the bottom of the carse-clays; and similar finds have frequently been recorded from the contemporaneous deposits in the valleys of the Forth and Clyde.

The latest conspicuous raised beach occurs at an average level of 25-30 feet above the sea. The only shells it has yielded belong to still indigenous species. Nowhere, so far as known, do the deposits of this beach merge inland into fluvio-glacial gravels, nor apparently are they anywhere associated with moraines. Often, however, the beach contains trunks and stools of pine and other trees of large size; while now and again it directly overlies peat with trunks and stools of trees rooted in an underlying soil. It is hard to say, however, whether these ancient land-surfaces may not, in some cases at least, occupy the same geological horizon as the woody peat met with in the Tay Valley below the older carse-clays of the 45-50 feet level.

Postponing for the present any further remarks on the evidence supplied by our post-glacial raised beaches, I would shortly direct attention to certain other accumulations which unquestionably belong to later times than the closing stage of the Glacial Period as previously defined. I refer to our peat-mosses. Every one knows that these frequently contain the remains of trees. In many places throughout Scotland—as well in high grounds as in low grounds—the peat-mosses cover two forest beds at least. Typically, the older forest layer occurs at the base of the peat, while the younger tier of trees rests upon and is covered by a variable thickness of the same material. In some bogs only a few feet may separate the two forest beds, while elsewhere the intervening peat may attain a thickness of many yards. Long ago I endeavoured to show that the general occurrence of these phenomena was indicative of climatic changes.[1] The forest beds, I maintained, were the products of relatively dry or continental conditions, while the intervening and overlying sheets of peat were evidence of colder and wetter conditions. I further drew attention to the fact that our peat-mosses are not now in a flourishing condition, but are all more or less

[1] *Trans. Roy. Soc. Edin.*, vol. xxiv. (1866), p. 363.

rapidly decaying and being denuded by rain and wind. Under favourable conditions peat is doubtless forming here and there, but this is exceptional—the rate of growth is much exceeded by the rate of decay and denudation. From this striking fact I inferred that the climate of Scotland had become drier since the formation of the peat that overlies our "upper forest bed."

The earlier writers on the origin of the Scottish peat did not recognise the influence of climatic changes in the overthrow of the old forests. According to them it was the destruction of the forests that had induced the formation of the peat-mosses—the work of destruction being attributed chiefly to man's hand, although it was allowed that other causes, such as tempestuous winds, might have had their share. The wholesale overthrow of the forests, it was believed, had obstructed the natural drainage of the land and thus brought about marshy conditions favourable to the growth of sphagnum and its allies. More recently it has been suggested that in certain cases the drainage may have been interrupted by the heaping up of banks of sand, clay, etc., across broad valleys, whereby the forests over wide areas may have been destroyed by stagnant water, and thus eventually replaced by bogs. This is a somewhat far-fetched explanation. If it had any evidence in its favour, that should not be hard to point out. Where, one might ask, are those convenient bars or banks behind which the stagnant water is supposed to have accumulated?

That none of these explanations can be accepted as sufficient to account for the phenomena of our peat bogs in general, is shown by the mere fact that the buried forests are not confined to the peat of low-lying and gently-undulating ground—to positions, namely, where the drainage might possibly have been disturbed by one or other of the causes suggested. On the contrary, they occur just as constantly in the peat of mountain-slopes and hill-tops, where, owing to the form of the ground, interruptions of the drainage could not possibly take place. Moreover, the almost invariable appearance, in the peat of low grounds and high grounds alike, of at least two buried forests obviously points to the operation of some widely-acting recurrent cause.

Conclusions similar to mine were subsequently advocated by the late Professor Blytt, who, after a careful study of the peat-mosses of Norway, was convinced that these gave evidence of a well-marked alternation of wet and relatively dry climatic conditions having obtained after the low grounds of that country had been vacated by the great "inland ice" of the Glacial Period. I need only add that the phenomena of successive "buried forests" have long been recognised as characterising the peat-bogs of Northern and North-West Europe. The occurrence of these trees, however, has been variously interpreted, some authors upholding views that are practically the same as those I ventured to set forth some forty years ago, while others would attribute the origin of the peat-mosses to the overthrow of the forests by the various causes already referred to.

When we come to inquire into the relation of our Scottish peat-mosses to the glacial deposits, we have no difficulty in ascertaining that they belong to a later date than the "epoch of district ice-sheets and

large valley-glaciers." This is shown by the fact that the peat with its buried trees overspreads the fluvio-glacial gravels and moraines of that epoch. Hence it would appear that our oldest post-glacial peat-mosses occupy precisely the same geological horizon as the peat and alluvia which underlie the carse-clays of the 45-50 feet level, and directly overlie the deposits of the 100-feet beach. We are thus led to the conclusion that the ancient land-surface buried underneath the carse-clays of the 45-50 feet beach is contemporaneous with the Lower Forest-zone of our inland peat-mosses. This correlation gives us the key to the history of all the later climatic and geographical changes experienced by our country.

Summing up the evidence thus briefly stated, we may recognise the following succession of events in the history of post-glacial Scotland:—

1. After the "district ice-sheets and large valley-glaciers" had disappeared, the land gained in extent, the sea eventually retreating considerably beyond the present coastline. The climate at the same time gradually improved until genial conditions supervened, and a strong forest growth covered the low grounds and extended upwards to elevations which trees in our country no longer attain. The relics of that great forest epoch we find in the "Lower Forest-zone" of our peat-mosses.

2. Next followed partial subsidence of the land, accompanied ere long by a relapse to cold conditions. Snowfields now reappeared, and considerable glaciers descended our mountain valleys, and in some places reached the sea. The climate was wet and ungenial—the forests decayed, and bog-mosses gradually usurped their place. To this stage we assign the "Lower Peat" of our inland "mosses" and the 45-50 feet beach, as well as certain moraines and fluvio-glacial gravels.

3. The succeeding stage was characterised by re-elevation of the land, and the retreat of the sea beyond the present coastline. But the land was probably not so extensive as during the earlier forest epoch. This geographical change was marked by the disappearance of perennial snow and ice, and by a return to dry genial conditions, apparently similar to those that formerly obtained. Forests again clothed the land —flourishing in many places over the surface of the now desiccated peat-mosses. This stage is represented by the "Upper Forest-zone" of our inland peat, and by the trees which occur under the deposits of the 25-30 feet beach.

4. Once more partial subsidence ensued, and the climate again became somewhat cold and wet. Over wide areas the forests, as before, began to decay, and were eventually buried under the rapidly extending peat-mosses. We cannot actually demonstrate that snowfields and glaciers reappeared at this stage. The latest beach we are able to correlate with the "Upper Peat," but that beach is nowhere associated with moraines or glacial gravels. Nevertheless, we are not without evidence suggestive of the appearance at this time of inconsiderable glaciers amongst our highest mountains. These small glaciers undoubtedly existed at a later date than the glaciers that dropped their moraines on the 45-50 feet beach. It is therefore not unreasonable to

infer that the high-level corrie-glaciers in question were probably contemporaneous with the formation of the 25-30 feet beach and the "Upper Peat" of our inland "mosses." But the chief evidence of cold wet conditions is unquestionably that furnished by the "Upper Peat" itself. It covers the "Upper Forest-zone" in precisely the same way as the "Lower Peat" overlies the "Lower Forest-zone."

5. The final stage witnessed the retreat of the sea to its present level. The climate now became drier, and peat-mosses ceased to flourish as they had done in the immediately preceding epoch. Thus the final phase of post-glacial history may be said to be characterised especially by the general decay and denudation of our peat-mosses—the vegetation growing upon which is almost invariably of a drier type than that found in the peat itself.

Did space permit I might follow other lines of evidence, all leading to the conclusion that oscillations of climate marked the closing stages of Pleistocene times. For example, the phenomena presented by the alluvial terraces of our larger river valleys might be cited. It would not be hard to show that during the so-called "post-glacial period" our rivers have at some stages been most active as eroding agents, while at other stages their chief work has been the transportation and deposition of sediment. During the genial epochs, when the land stood at a higher level than now, the rivers busied themselves especially in deepening and widening their courses—in sweeping away the glacial and fluvio-glacial detritus with which their valleys had been so largely choked. During the cold wet epochs the land was depressed below its present level, and the larger rivers were then chiefly engaged in filling up the lower reaches of their valleys with abundant sediment. In a word, epochs of dominant erosion alternated with epochs of dominant deposition.

In support of my general conclusions I might also appeal to certain facts relating to the present and past geographical distribution of animals and plants. The appearance, for example, in the North Atlantic of isolated colonies of southern types of molluscs, surrounded on all sides by boreal and cold-temperate forms, and the occurrence now and again of similar no longer indigenous molluscs in the raised beaches of Nova Scotia, Greenland, Spitzbergen, and Scandinavia, are alike strongly suggestive of warmer conditions having at a very recent period characterised the North Atlantic. Quite in keeping with these phenomena is the fact that the beaches in question are often crowded with southern types which, although still lingering on in these northern seas, do not now attain so large a size as their post-glacial predecessors, while they are obviously much less abundant.

But these and other lines of evidence (especially those afforded by the geographical distribution of plants in Temperate Europe) can hardly be discussed in this place.

Although the more obvious proofs of alternating genial and ungenial climates supplied by our peat-mosses seem to me too strong to be resisted—fortified as they are by the evidence yielded by our raised beaches and recent morainic accumulations—I have yet long been of opinion that they would probably be strengthened by a systematic

botanical examination of the peat itself. I could not doubt that a study of the several layers of vegetable matter of which peat-mosses are composed would throw light on the character of the climate that obtained during their accumulation. It was obvious to me, although no expert in botany, that bog-mosses were not the only constituents of peat: in many sections I could see what appeared to be a succession of layers made up of the remains of different kinds of plants. And often have I regretted the ignorance which forbade any attempt on my part to interpret what that succession meant; for I felt sure it had some interesting tale to tell. Fortunately the work of interpretation has at last been taken up by an accomplished botanist. Mr. Francis J. Lewis, of the University of Liverpool, has during the last few years subjected our peat-mosses to a careful examination, with results that are sufficiently striking. His work is not yet completed, but he has already studied the peat of our Southern Uplands and carried on similar researches throughout wide areas in the Highlands. The data now collected have convinced him that a definite succession of plants everywhere characterises the Scottish peat; and he confirms the view of alternating climatic conditions which I ventured to set forth so many years ago.

The Southern Uplands is the general term applied to that belt of hilly and mountainous country which extends from the coasts of South Ayrshire and Wigtownshire to the high grounds that terminate on the East Coast between the valleys of the Tweed and the Tyne. Throughout this broad tract peat-mosses abound—large areas of the higher ground being of a dominantly moorland character. Nowhere are the peat-mosses better developed than in the mountainous district of Merrick in Galloway and in the lofty region in which the River Tweed takes its rise. To these two typical areas Mr. Lewis has devoted special attention, and the results of his observations have already been published.[1] In both districts the peat-mosses bear the same relation to the glacial and fluvio-glacial deposits—they everywhere overlie the moraines and morainic detritus of our "district ice-sheets and large valley-glaciers."

In a recent number of this *Magazine*[2] Mr. Lewis has given a very interesting account of his researches to which I would refer the reader. But I will here take the liberty of summarising very shortly those of his results which are of the highest importance from the point of view of Historical Geology. According to him the first well-marked zone at the base of the peat in the Southern Uplands is a solid layer of the remains of white birch (*Betula alba*), mixed with such plants as heather (*Calluna vulgaris*) and willow (*Salix repens*). Mr. Lewis thinks it is hardly possible that this zone represents the primitive vegetation which covered the Uplands immediately after the disappearance of glacial conditions. The first comers would naturally be arctic types, the preservation of which, however, would entirely depend upon climatic and local conditions. In the Merrick district Mr. Lewis observed that

[1] "The Plant Remains in the Scottish Peat Mosses. Part I.—The Scottish Southern Uplands." *Trans. Royal Soc. Edin.*, vol. xli. (1905), p. 699.

[2] *Scottish Geographical Magazine*, May 1906, p. 241.

in many places a thin layer of peat occurred immediately underneath the birch zone, but unfortunately the material was in too decomposed a condition to allow of the identification of any particular plants. It is quite possible, he thinks, that the structureless peat referred to may represent the primitive vegetation of the district. I may remark that similar structureless peat not infrequently underlies the lower forest-zone in the peat-bogs of Scandinavia. That the white birch and its congeners were preceded in the low grounds by a truly arctic flora is shown, as already pointed out, by the occurrence in certain lacustrine alluvia of the polar willow and other northern types, which flourished during the latest glacial stage, *i.e.* the epoch of "district ice-sheets and large valley-glaciers."

The birch zone is directly overlaid by a thick stratum of peat, composed entirely of bog-moss (*Sphagnum*). This succession is constantly repeated throughout the Southern Uplands, alike in the peat at the bottoms of valleys and in that upon steep hill-sides and flat hill-tops. The Sphagnum bed thus bears witness to a general increase of precipitation; it represents, in short, a change from birch-forest conditions to wet moorland.

As successive layers of the peat are followed upwards, Mr. Lewis finds that the bog-moss gradually gives place to cotton-grass (*Eriophorum vaginatum*) and rushes (*Scirpus*). After these plants had flourished for some considerable time, a decided change of climate supervened. In the Merrick district the cotton-grass peat is covered by a dense layer of the stems of crowberry (*Empetrum nigrum*) and two characteristic arctic willows (*Salix herbacea* and *S. reticulata*). The same zone is represented in the peat of Tweedsmuir by the crowberry and the creeping azalea (*Loiseleuria procumbens*), the latter being a typical arctic form. The constant appearance of this remarkable zone throughout the Southern Uplands can have only one meaning—it points unmistakably to a decided decrease of temperature. It indicates a stage during which the valleys of Southern Scotland were characterised by a climate as rigorous as that now experienced on the summits of our loftiest mountains.

The gradual dying away of this cold epoch and the re-appearance of forest vegetation are, according to Mr. Lewis, faithfully chronicled in the peat. The crowberry, the arctic willows, and the creeping azalea give place above to cotton-grass, and this in its turn to bog-moss or Sphagnum—a succession common to the peat throughout the Southern Uplands. Eventually the wet moorland conditions indicated by the Sphagnum-peat passed away; the bogs dried up and were invaded by trees, by forests of pine in the Merrick district, and forests of white birch in Tweedsmuir.

Finally, the conditions again became adverse to forest-growth, and the trees of this upper zone were gradually buried under a stratum of peat, consisting chiefly of rushes, bog-moss, and cotton-grass.

In comparing the peat-mosses of the Southern Uplands with those of the Northern Highlands, Mr. Lewis finds that the latter begin their history at a later stage than the former. At high levels in the

Highlands none of the beds underlying the zone of arctic plants in the Southern Uplands puts in an appearance. The reason for this is obvious. The recurrence of cold conditions indicated by the arctic plants of the Southern Uplands was more strongly marked in the Northern Highlands. In those elevated regions considerable snowfields and glaciers re-appeared, and all peat-beds representing the Lower Forest-zone of Southern Scotland were swept away. As these glaciers in the north began to retreat, a vegetation like that of the Tundras invaded the formerly glaciated tracts. Arctic willows (*Salix reticulata* and *S. herbacea*) at first were dominant forms, but these gradually gave place to sub-arctic types (*Salix Arbuscula*, *Betula nana*, *Empetrum nigrum*, etc.). By and by this sub-arctic brushwood disappeared and was succeeded by a close growth of cotton-grass and bog-moss, interspersed with some scraggy birch. That humid conditions eventually became intensified is suggested by the fact that the birch in its turn vanished, and Sphagnum alone continued for a long time to occupy the ground. These wet moorland conditions next passed away, the thick Sphagnum-peat drying up, and eventually supporting a forest of large pines with an undergrowth of common heather. The great pines of this upper zone, it may be mentioned, flourished at elevations between 2000 and 3000 feet above the present sea-level. Finally they decayed and were gradually buried under peat, consisting chiefly of bog-moss and rushes.

My limits will not allow me to enter into other interesting evidence adduced by Mr. Lewis. I may mention, however, that he agrees with me that existing conditions no longer favour the general growth of peat. On hill-top, hill-side, and in upland valleys alike the peat, he says, is almost without exception being rapidly wasted away. The vegetation at present covering the peat is nearly always of a drier type than that occurring at slightly greater depths—a fact, he remarks, not without its bearing upon the present denuded state of the "mosses."

From this brief and imperfect summary of the results obtained by Mr. Lewis, it will be admitted that the geological evidence of climatic changes in so-called "post-glacial" times has been much strengthened. It is most satisfactory to learn that a distinct zone of arctic plants is intercalated in the peat. The occurrence of these plants midway between the two forest-zones, and the succession of plant-remains in the peat-beds immediately underlying and overlying the arctic-plant zone—all point to a gradual change, first from dry forest to wet moorland and from wet moorland to cold tundra, and then back again from cold tundra to wet moorland and from the latter to dry forest.

In the peat overlying the "Upper Forest-zone" no trace of arctic plants has been met with. Mr. Lewis thinks it is possible, however, that these may yet be detected in high-level peat-mosses which were formed contemporaneously with the moraines of the youngest corrie-glaciers. It may be so; but I doubt whether the wet and relatively cold conditions indicated by the high-level corrie-moraines and the peat which covers the "Upper Forest-zone," were sufficiently pronounced to induce any conspicuous modification of the flora. All we can infer is that the climate was inclement enough to check forest-growth and to favour the increase of

bog-moss and its allies. The temperature, however, need not have differed greatly from the present. Only a slight lowering of the present temperature, with a correspondingly small increase of precipitation, would cover our highest mountains with perennial snow-caps and reproduce their corrie-glaciers.

The various superficial accumulations which have formed the subject of this article are usually classified as *post-glacial*. But since they obviously carry on the story revealed by the older glacial and inter-glacial deposits, they ought not, in my opinion, to be separated from these. They form the concluding chapters of the history of Pleistocene times. That great cycle of climatic oscillations, which commenced before the close of the Pliocene period and reached down to the dawn of the Present, forms one of the most remarkable episodes of the past, and ought to be recognised in our classification as constituting a distinct division of time. By refusing to do so and including in the Pliocene the "Weybourn Crag" with its arctic fauna, and the "Cromer Forest-bed Series," etc., we cut off from the Pleistocene the earliest recognisable glacial and inter-glacial epochs; and we similarly separate from the great cycle its closing phases when we classify these as "post-glacial." So far as Britain is concerned, it is only the Present which is post-glacial.

How many climatic oscillations took place during the great glacial cycle we cannot tell; quite possibly those which are represented in the Pliocene are not the earliest of the series. If we confine attention to such glacial and inter-glacial stages as are known, it would seem that the climax of each phase was attained in early Pleistocene times. After that climax was passed each successive cold and genial epoch declined in importance—the contrast between the two phases gradually became less pronounced. Inter-glacial conditions seem to have reached their maximum development with the advent in England of the southern pachyderms—hippopotamus, elephant, and others—and died out with the disappearance of the great forests whose remains are covered by our "upper peat." Glacial conditions culminated with the enormous ice-sheet underneath which our lower boulder-clay was accumulated, and finally disappeared with the isolated snowfields and diminutive glaciers of our loftiest Highland mountains.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.[1]

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART X.—THE LOCHS OF THE NAVER, BORGIE, KINLOCH, AND HOPE BASINS.

IN this paper it is proposed to deal with the lochs of north-west Sutherlandshire, draining by the rivers Naver, Borgie, Kinloch, and Hope into

[1] Abbreviated from article, with maps, in *Geographical Journal* for February 1906.

the North Atlantic, along the north coast of Scotland, which have been sounded by the staff of the Lake Survey, viz. Lochs na Meide, Naver, a' Bhealaich, Coir' an Fheàrna, Syre, Cùil na Sìthe, Laoghal, Creagach, Chaluim, an Dithreibh, and Hope. The district under consideration extends from Loch Eriboll and Torrisdale bay on the north to Ben Armine and Meall a' Fhuarain on the south, and Ben Hee, Meallan Liath, and Meall Horn on the west, including also the mighty peaks of Ben Hope and Ben Klibreck, which exceed 3000 feet in height. The scenery of the district may be described as wild, grand, and mountainous. The total area of the four basins, as measured by the planimeter on the 1-inch Ordnance Survey maps, is about 382 square miles, as follows :—

Naver basin	199	square miles.
Borgie „	62	„
Kinloch „	46	„
Hope „	75	„
	382	„

Of this area, about 240 square miles (or nearly two-thirds) drain into the lochs under discussion. These lochs include the largest in the extreme north of Scotland, five of them exceeding three miles in length, while two of them exceed six miles in length. Three of the lochs have each a superficial area exceeding 2 square miles, the largest in this respect being Loch Laoghal, which, though only 4½ miles in length as compared with the 6 miles of Lochs Naver and Hope, exceeds the two last-named lochs both in maximum breadth and mean breadth. Loch Laoghal has also the distinction of being the deepest of the series, and of containing the largest volume of water. The lochs are famous for their fishing, but most of them are preserved ; they all contain fine trout, and *Salmo ferox* has been taken in Lochs Naver, a' Bhealaich, Laoghal, and Creagach, and salmon in Lochs Naver and Coir' an Fheàrna.

1. Lochs of the Naver Basin.

There are five lochs within this basin to be dealt with here, of which the largest is Loch Naver, though Loch Coir' an Fheàrna has a greater depth ; a few small lochs within the basin could not be sounded by the Lake Survey for lack of boats. The overflow from Loch na Meide is carried by the Amhainn Bheag and River of Mudale into Loch Naver, and shortly after leaving Loch Naver the river Naver is joined by the river Mallart, bearing the overflow from Lochs a' Bhealaich and Coir' an Fheàrna, while still further on the river Naver is joined by the Langdale Burn, bearing the overflow from Loch Syre. Of the total area of the basin, about 119 square miles, or 60 per cent., drain into these five lochs.

Loch na Meide.—Loch na Meide (or Meadie) lies about 10 miles to the south of Tongue, and about 22 miles to the north of Lairg, which is the nearest railway station. It trends nearly north and south, and is

very irregular in outline, the northern portion being narrow, while the southern portion widens out considerably; there is a very narrow and shallow constriction near the middle, which practically cuts the loch into two portions. It is $3\frac{1}{3}$ miles in length, and has a maximum breadth near the southern end of over a mile, the mean breadth of the entire loch being a quarter of a mile. Its waters cover an area of about 555 acres, or nearly 1 square mile, and it drains an area of 8 square miles. The maximum depth of 63 feet was observed in the wide southern portion of the loch, but towards the eastern shore, about 650 yards from the southern end, and only about 100 yards from one of the small unnamed islands. The volume of water is estimated at 498 million cubic feet, and the mean depth at $20\frac{1}{2}$ feet. The loch was surveyed on September 25, 1902, when the elevation of the lake-surface was found by levelling from bench-mark to be 488·35 feet above the sea.

Loch na Meide is very irregular in conformation, with many small islands in the southern half, the largest of which is named Eilean Mòr. The deepest water was found near the southern end; a sounding in 44 feet was taken about 200 yards from the southern shore, and there is a small area about one-third of a mile in length exceeding 50 feet in depth. In close proximity a sounding of 22 feet was taken, surrounded on all sides by deeper water. On approaching the central constriction, in which the depth is only 2 feet, the water shoals gradually though irregularly, and deepens again on proceeding towards the northern end, where a maximum depth of 40 feet was observed about half a mile from the upper end, and where there is a small area about one-third of a mile in length exceeding 30 feet in depth. On the whole Loch na Meide is rather shallow, since 70 per cent. of the lake-floor is covered by less than 25 feet of water.

The temperature of the surface water at 10 A.M. on the date of the survey was 53·0° Fahr., the air-temperature being 60°. The deposits brought up were all very dark (black) muds.

Loch Naver.—Loch Naver lies about 5 miles to the south-east of Loch na Meide, with Ben Klibreck to the south rising gently up from the shore of the loch. Altnaharra Inn, at the west end of the loch, is a well-known rendezvous for anglers. On the northern shore Reidhach-aisteil and Gruamamor, and on the southern shore Ruighnasealbhaig, are the remains of considerable villages destroyed at the beginning of last century when the crofters were turned out. There are the ruins of Pictish towers near Gruamamor and on the island close to the opposite (southern) shore, and the remains of several artificial crannogs rise towards the surface of the water, in one case reaching above the surface. Loch Naver is broadly sinuous in outline, the general trend being east-north-east and west-south-west, while the upper portion for about a mile runs east and west, and it exceeds 6 miles in length. It is a comparatively narrow loch, the maximum width towards the west end not exceeding two-thirds of a mile, whence the width gradually diminishes towards the east end, the mean breadth of the entire loch being about one-third of a mile, or 6 per cent. of the length. Its waters cover an area of

about 1446 acres, or $2\frac{1}{2}$ square miles, and it drains directly an area of nearly 81 square miles; but since it receives the outflow from Loch na Meide, its total drainage area is nearly 89 square miles. The maximum depth of 108 feet was observed in the wider part of the loch about a mile from the west end. The volume of water contained in the loch is estimated at 2461 millions of cubic feet, and the mean depth at 39 feet. The loch was surveyed on September 24 and 25, 1902, when the elevation of the lake-surface was determined by levelling from bench-marks as being 247·6 feet above the sea; when visited by the officers of the Ordnance Survey on June 24, 1870, the elevation was found to be 246·9 feet above sea-level. The highest drift-mark observed was $4\frac{1}{2}$ feet above the surface of the water at the time of the survey, and it was said that the water might fall to the extent of 4 feet, giving a range in level of about $8\frac{1}{2}$ feet.

The floor of Loch Naver is rather irregular, as may be seen in a longitudinal section taken along the axis of maximum depth, which shows how the bottom rises and falls on proceeding from one end of the loch to the other. The 25-feet contour-line is discontinuous opposite the entrance of the Allt Gruama Beag, where the deepest sounding was 24 feet, the water deepening both to the east and to the west. The 50-feet contour is continuous, enclosing an area nearly 4 miles in length, distant from the east end about $1\frac{3}{4}$ miles, and approaching to within one-third of a mile from the west end; within this area, however, the bottom rises in two places, where soundings of 40 and 43 feet were taken. There is a small isolated 75-feet area opposite Càrn Gruama Beag, based on soundings of 76 and 80 feet, separated from the principal 75-feet basin by an interval of over a quarter of a mile, in which the greatest depth is 62 feet; the main 75-feet area is $2\frac{1}{2}$ miles in length, and approaches to within three-quarters of a mile from the west end. There are two very small 100-feet areas, based upon isolated soundings of 100 and 108 feet, the former opposite Gruamamor, the latter farther up the loch west of Reidhachaisteil. A short distance to the west of the deepest sounding (108 feet) is the rise of the bottom already mentioned, covered by 40 feet of water, and to the north-east near the northern shore is a bank covered by only 1 foot of water surrounded by much deeper water. Off the southern shore at Coill Ach' a' Chuil, towards the east end of the loch, is another bank with 6 feet of water on it, in close proximity to a sounding of 30 feet.

Temperature observations taken on September 24, 1902, gave readings of 54° Fahr. at the surface, at 25 feet, and at 50 feet; while at 80 feet the temperature was 53·5°, the air-temperature at the time being 59°.

Loch a' Bhealaich.—Loch a' Bhealaich (or a-Vellich or Vealloch) lies about $4\frac{1}{2}$ miles to the south of the western portion of Loch Naver, with Ben Klibreck rising between them. It is almost continuous with the larger Loch Coir' an Fheàrna, the connecting stream between them being only about 200 yards in length, and the difference in level less than 2 feet. To the north of the two lochs Ben Klibreck slopes gently up to

over 3000 feet, while the ground to the south is not so high, but much steeper; so steep is that around Loch a' Bhealaich (which lies in a very fine corrie) that even at noon on the date of the survey the sun could not be seen, except by going over the north-west shore. The two lochs trend in a north-east and south-west direction, and together have a total length of $4\frac{3}{4}$ miles. Loch a' Bhealaich exceeds $1\frac{1}{2}$ miles in length, with a maximum breadth of a quarter of a mile. Its waters cover an area of about 175 acres, or over a quarter of a square mile, and it drains an area of nearly six square miles. The maximum depth of 80 feet was observed towards the north-east end of the loch. The volume of water is estimated at 238 million cubic feet, and the mean depth at over 31 feet. The loch was surveyed on October 17, 1902, when the elevation of the lake-surface was found to be 572·2 feet above sea-level. The water might rise 2 or 3 feet above, and fall about $1\frac{1}{2}$ feet below, that level.

The main body of Loch a' Bhealaich is quite simple in conformation, but at the north-east end there is a small expansion of the loch, having a maximum depth of 14 feet, separated from the main body by a constriction in which the depth is 9 feet. The 25-feet area is over a mile, and the 50-feet area over half a mile, in length, the deeper water being contained in the north-eastern half of the loch, the deepest sounding in 80 feet having been taken about a quarter of a mile from the north-eastern shore.

Temperature observations taken in the deepest part of the loch gave 48·9° Fahr. at the surface and at 40 feet, a reading at 76 feet giving 48·4°.

Loch Coir' an Fheàrna.—Loch Coir' an Fheàrna (or Corr, or a-Choire) is a fine sheet of water, well wooded along the south-eastern shore, the Duke of Sutherland's lodge standing at the lower (north-eastern) end. It is over three miles in length and comparatively uniform in breadth, the maximum breadth being half a mile, and the mean breadth over one-third of a mile. Its waters cover an area of about 737 acres (considerably over one square mile), and it drains directly an area of about $18\frac{1}{2}$ square miles, but since it receives the outflow from Loch a' Bhealaich, its total drainage area is about $24\frac{1}{2}$ square miles. The maximum depth of 151 feet was observed comparatively near the south-west end. The volume of water is estimated at 1886 millions of cubic feet, and the mean depth at nearly 59 feet. The loch was surveyed on October 15 to 17, 1902; the elevation of the lake-surface on commencing the survey on the 15th was found to be 569·7 feet above sea-level, but the water rose to the extent of 9 inches by the 17th, when Loch a' Bhealaich was surveyed. On the 15th the water was about its lowest level, and might rise 2 or 3 feet.

Loch Coir' an Fheàrna is quite simple in conformation, with the deeper water lying towards the south-west end—that is, towards the peninsula separating it from Loch a' Bhealaich, and the fact that in Loch a' Bhealaich the deeper water also approaches the separating peninsula seems to suggest that the two lochs may at one time have been continuous. The contour-lines all enclose continuous areas

approaching much nearer to the south-west than to the north-east end, indicating a more gentle slope towards the north-east. Thus the 100-feet area is distant about three-quarters of a mile from the north-east end, but approaching to within less than a quarter of a mile from the south-west end, and the maximum depth of 151 feet was about half a mile from the south-west end. The slope along the south-east shore is as a rule steeper than along the opposite shore, and this is especially the case off Creag Chraobhach, at the position of the deepest sounding, where a sounding in 46 feet was taken about 50 feet from shore.

Temperature observations taken in the deepest part of the loch at 1.30 P.M. on October 16, 1902, gave readings of 50·0° Fahr. at the surface, at 20 feet, and at 80 feet, and a reading of 49·8° at 130 feet, the air-temperature being 45°.

Loch Syre.—Loch Syre lies about 3½ miles to the north of the east end of Loch Naver, on the high ground between Strath Naver and Loch Laoghal, the last-named loch being only about 1½ miles distant to the west. It is an irregular shallow loch, with several islands in it, and the eastern part is full of stones. From east to west it has a length of nearly three-quarters of a mile, with a maximum breadth of over half a mile. Its waters cover an area of about 106 acres, and it drains an area of over 5 square miles. The maximum depth of 12 feet was observed in the south-eastern part of the loch. The volume of water is estimated at 25 million cubic feet, and the mean depth at 5½ feet. The loch was surveyed on October 1, 1902, when the elevation of the lake-surface was found to be 412·8 feet above the sea; when levelled by the officers of the Ordnance Survey on July 23, 1870, the elevation was 411·4 feet above sea-level. The level of the loch has been raised over a foot by means of a dam above the first island, and it was proposed to raise it still further to the extent of 2 or 3 feet. At the time of the survey the highest drift-mark observed was about 2 feet above the water, which might fall about a foot.

The floor of Loch Syre is irregular, as might be expected from its extremely irregular outline and many islands. The deepest water was found in the south-eastern angle of the loch, where there is a small area over 10 feet in depth, the deepest cast of 12 feet having been taken about 100 yards from the eastern shore and 150 yards from the southern shore. Between the deepest sounding and the southern shore the bottom rises to 9 feet and sinks again to 11 feet close inshore. The area of the lake-floor covered by less than 10 feet of water is about 97 acres, or 92 per cent. of the entire area of the loch. The temperature of the surface water on the date of the survey was 54·7° Fahr., the air-temperature being 51° Fahr.

2. Lochs of the Borgie Basin.

The three lochs to be dealt with here form a connected series, the overflow from Loch Cùil na Sìthe being carried into Loch Laoghal by the Lòn Achadh na h-Aibhne, while Lochs Laoghal and Creagach are

almost continuous, the connecting stream being only about 200 yards in length. Of the total area of the basin, about 35 square miles, or 56 per cent., drain into these three lochs.

Loch Cùil na Sìthe.—Loch Cùil na Sìthe (or Coulside) is a small narrow loch lying over a mile to the west of the head of Loch Laoghal, and about 5 miles to the north of Altnaharra, at the head of Loch Naver. It trends east-north-east and west-south-west, and is very nearly a mile in length, varying little in width, the maximum breadth being about 250 yards. Its waters cover an area of about 58 acres, and it receives the drainage from a comparatively large tract of country, the drainage area being about 9 square miles—an area a hundred times greater than that of the loch. The maximum depth of 14 feet was observed in two places near the middle of the loch. The volume of water is estimated at 19 million cubic feet, and the mean depth at $7\frac{1}{2}$ feet. The loch was surveyed on September 29, 1902, but the elevation of the lake-surface above the sea could not be determined; a drift-mark was observed over 6 feet above the water, which might fall to the extent of a foot, giving a range in level exceeding 7 feet.

Loch Cùil na Sìthe is extremely simple in conformation, and comparatively uniform in depth. The upper portion is being silted up, and is occupied by weeds, and the lower portion is full of stones. The 10-feet contour coincides approximately with the outline of the loch, and encloses an area of about 20 acres, or 35 per cent. of the total area of the loch. The temperature of the surface water on the date of the survey was 56·2° Fahr., and a reading at a depth of 11 feet gave 53·9°.

Loch Laoghal.—Loch Laoghal (or Loyal) is distant about $4\frac{1}{2}$ miles from Tongue, and about 6 miles from Altnaharra, the road between these two places running alongside the western shore of the loch throughout its whole length. To the west rises Ben Loyal, one of the most beautiful of mountains, with picturesque outline, the highest point exceeding 2500 feet; beyond Leitirmhòr the granite is being quarried for building purposes, leaving a great scar on the hillside. To the east of the northern portion of the loch rises Beinn's Tomaine (Ben Stomino) to a height of 1728 feet, along the base of which the shore of the loch is thickly wooded. In outline the loch resembles somewhat a Wellington boot, with the toe pointing in a westerly direction, while the body of the loch trends almost north and south. The loch is $4\frac{1}{2}$ miles in length, with a maximum breadth of nearly a mile, the mean breadth exceeding half a mile. The waters of the loch cover an area of about 1630 acres, or over $2\frac{1}{2}$ square miles, and it drains directly an area of over 24 square miles, but since it receives the overflow from Loch Cùil na Sìthe, its total drainage area exceeds 33 square miles. The maximum depth of 217 feet was observed near the foot of the loch, little more than half a mile from the northern shore. The volume of water contained in the loch is estimated at 4628 millions of cubic feet, and the mean depth at $65\frac{1}{4}$ feet. The loch was surveyed on September 26 to 29, 1902, and the elevation of the lake-surface on commencing the survey was found,

by levelling from bench-mark, to be 369·9 feet above the sea; when levelled by the officers of the Ordnance Survey on August 29, 1870, the elevation was found to be 359·2 feet above sea level. The highest drift-mark observed was $2\frac{1}{2}$ feet above the surface of the water at the time of the survey, and it was stated that the water might fall to the extent of a foot.

Loch Laoghal contains two deep basins, the larger and deeper in the northern portion of the loch, and the smaller and shallower towards the head of the loch, separated by a shoaling of the bottom about $2\frac{1}{2}$ miles from the foot of the loch, where there is a slight constriction in the outline. The 50-feet contour-line is continuous, and encloses an area about 4 miles in length, extending from quite close to the northern end to within half a mile from the south-western end. There are two 100-feet basins: the smaller one approaches to within less than a mile from the head of the loch, and is three-quarters of a mile in length, the maximum depth observed therein being 137 feet, about $1\frac{1}{2}$ miles from the south-west end; the larger one is over 2 miles in length, and approaches to within about 250 yards from the northern end, enclosing the deepest part of the loch. The 150-feet area is about $1\frac{1}{4}$ miles in length, and distant about a quarter of a mile from the northern end. The 200-feet area is nearly three-quarters of a mile in length, distant less than half a mile from the northern end. A longitudinal section of the basin shows how rapidly the water deepens on proceeding from the northern end along the central line of the loch, while the opposite end of the loch is comparatively shallow and the slope of the bottom there gentle; it also shows the considerable rise of the bottom between the two deep basins. If a cross-section is taken at the position of the deepest sounding, it shows a slight rise of the bottom off the western shore from 80 to 75 feet. This section shows a steep off-shore slope at both sides of the loch, but more especially off the eastern shore, where a sounding in 78 feet was taken about 80 feet from shore, and this steep slope off the eastern shore is continued to the northward, where a sounding in 48 feet was taken about 60 feet from shore. The soundings taken on the rise between the two deep basins indicate a rather uneven floor; for instance, one line of soundings from west to east shows that the bottom sinks gradually from the western shore to 86 feet, then rises to 60 feet, sinks to 75 feet, rises to 30 feet, sinks slightly again to 32 feet, and then rises towards the eastern shore; a little further south a sounding was taken in 40 feet between two deeper soundings (54 and 57 feet).

Temperature Observations.—Many observations of the temperature of the surface water in Loch Laoghal were taken on September 26, 27, and 29, 1902, and two serial temperatures were taken on September 29, one in each of the two deep basins. The surface temperature varied from 52·5° to 53·6° Fahr., the temperature of the air during the same period varying from 55° to 58°.

The serial observations show an extreme range throughout the loch amounting to 7·5°, but the greater part of this range was observed beyond the depth of 100 feet in the deepest part of the loch, the range

from the surface down to 100 feet not exceeding 1·4°. In the southern shallower basin the temperature varied little down to the bottom in 135 feet, there being no decrease in temperature beyond 100 feet, whereas at a depth of 135 feet in the northern deeper basin the temperature was 4·5 lower than at a similar depth in the southern basin, and the temperature at the bottom of the deeper basin was 6° lower than anything observed in the shallower basin.

Loch Creagach.—Loch Creagach (or Craggie) lies immediately to the north of Loch Laoghal and at the same level, the short stream between them having a slight current flowing from Loch Laoghal into Loch Creagach. At the north end of Loch Creagach there is a small expansion of the outflowing river, called Loch Slaim (or Slam), which was not sounded. The general trend of Loch Creagach is nearly north and south, with a slight bend in the outline, the northern portion running towards the north-east. It is over $1\frac{1}{2}$ miles in length, with a maximum width in the southern portion of half a mile. Its waters cover an area of nearly 300 acres, or nearly half a square mile, and it drains directly an area of $1\frac{3}{4}$ square miles; but since it receives the outflow from Lochs Laoghal and Cùil na Sìthe, its total drainage area is nearly 35 square miles. The maximum depth of 84 feet was observed near the middle of the loch. The volume of water is estimated at 429 million cubic feet, and the mean depth at 33 feet. The loch was surveyed on September 27, 1902, when the elevation of the lake-surface was found to be identical with that of Loch Laoghal, viz. 369·9 feet above the sea; when levelled by the Ordnance Survey officers on August 27, 1870, the elevation was 369·2 feet above sea-level, as in the case of Loch Laoghal.

Loch Creagach resembles Loch Laoghal in that it contains two deep basins, which are separated by shallower water at the position of the constriction in the outline of the loch towards the northern end. The deeper basin occupies the wide southern portion of the loch, towards the peninsula separating this loch from Loch Laoghal, in which also the deeper water approaches the dividing peninsula, suggesting that at one time the two lochs may have formed a continuous sheet of water. The principal 50-feet area is about three-quarters of a mile in length, distant less than a quarter of a mile from the southern end of the loch. Within this basin there is a small elevation covered by 47 feet of water in the widest part of the loch towards the eastern shore. The maximum depth of the loch (84 feet) occurs a short distance to the north of this elevation, and about three-quarters of a mile from both ends, but towards the western shore. Towards the northern end of the loch lies the second 50-feet area, based on soundings of 50 and 51 feet, and of small extent, the greatest depth recorded on the ridge separating the two deep basins being 20 feet close to the eastern shore.

The temperature of the surface water on the date of the survey was 54° Fahr., and four readings beneath the surface in the deepest part of the loch gave identical results, viz. 53° at depths of 10, 25, 50, and 70 feet, the air-temperature being 59°.

3. Lochs of the Kinloch Basin.

There are two lochs to be dealt with here, viz. Loch Chaluim and Loch an Dithreibh, the superfluent waters of which are carried into the Kyle of Tongue by the Amhainn Ceann Locha (or Kinloch river). Loch Chaluim is the only one of several small lochs in the basin which could be sounded, and it flows by the Allt an Dithreibh into Loch an Dithreibh. The two lochs form a complete contrast in outline and conformation of the bottom.

Loch Chaluim.—Loch Chaluim lies on the south-western flank of Beinn Laoghal, little more than a mile from Loch Cùil na Sìthe in the Borgie basin. It is most irregular in outline and in conformation, with one comparatively large island, and with weeds obstructing many of the bays. Measured in a south-west and north-east direction, it is about three-quarters of a mile in length, with a maximum breadth of half a mile, its waters covering an area of about 96 acres. The maximum depth of 30 feet was observed in the extreme western portion of the loch, the mean depth being estimated at 8 feet, and the volume of water at 33 million cubic feet. The loch was surveyed on September 29, 1902, but the elevation of the lake-surface above the sea could not be determined.

Loch Chaluim is on the whole shallow, only three soundings exceeding 20 feet having been recorded in the most westerly expansion of the loch. There are two 10-feet basins, the principal one extending from the extreme west end of the loch to beyond the island, filling up the south-western expansion of the loch to the south of the island, and enclosing the deepest part of the loch, the smaller one lying in the eastern and south-eastern expansions of the loch, and having a maximum depth of 17 feet. The greater part of the lake-floor is covered by less than 10 feet of water, equal to about 69 acres, or 72 per cent. of the total area.

Loch an Dithreibh.—Loch an Dithreibh (or Deerie, or Derry) lies less than 3 miles to the south of the head of the Kyle of Tongue, with Ben Loyal to the east and the lofty Ben Hope, a magnificent object in the landscape, to the west. The general trend of the loch is north-north-east and south-south-west, the main body of the loch trending almost north and south, and throwing out an arm towards the north-east. The loch is over $1\frac{1}{2}$ miles in length, the main body being approximately uniform in width, with a maximum breadth of two-thirds of a mile, while the north-eastern arm is much narrower; the mean breadth of the entire loch is nearly half a mile. Its waters cover an area of about 475 acres, or three-quarters of a square mile, and it drains directly an area of 10 square miles; but since it receives the overflow from Loch Chaluim, its total drainage area is $12\frac{2}{3}$ square miles. The maximum depth of 157 feet was observed approximately near the centre of the main body of the loch. The volume of water is estimated at 1366 million cubic feet, and the mean depth at 66 feet. The loch was surveyed on October 1, 1902,

when the elevation of the lake-surface was found, by levelling from bench-mark, to be 267·45 feet above the sea; when levelled by the officers of the Ordnance Survey on October 26, 1870, the elevation was 267·8 feet above sea-level.

Loch an Dithreibh includes two basins: (1) a larger deep basin in the main body of the loch, and (2) a smaller shallower basin in the north-eastern arm, separated by a rise of the bottom on which the deepest sounding was 49 feet. The maximum depth observed in the small subsidiary basin was 59 feet, and the separating ridge is irregular, for a sounding in 21 feet was taken in its central part surrounded by deeper water. The 25-feet contour-line is continuous from end to end of the loch, coinciding approximately with the outline of the loch, but approaching close to the eastern shore off Creag an Dithreibh and Creag na Luath-ghaire. The 50-feet area is cut into two portions, as already indicated, the main portion approaching close to the southern end of the loch and exceeding 1 mile in length. The 75-feet area is nearly a mile in length, and at its northern border the lake-floor shows conspicuous undulations, giving to the 75-feet contour-line a strikingly sinuous character. The 100-feet area has a length of three-quarters of a mile, approaching comparatively very close to the southern shore, where a sounding in 115 feet was recorded about 150 yards off shore. The 125-feet area exceeds half a mile in length, and the small 150-feet area, based upon soundings of 151, 152, and 157 feet, occupies an approximately central position. Along the eastern shore the slope of the bottom is in places very steep. Off Creag na Luath-ghaire a sounding of 40 feet was taken about 80 feet off shore, and another sounding in 49 feet about 70 feet off shore, while off Creag an Dithreibh one sounding was taken in 65 feet about 100 feet off shore, and another sounding in 65 feet about 60 feet off shore. This last-mentioned sounding gives an angle of slope exceeding 45°, the fall exceeding 1 foot per foot.

Temperature Observations.—A series of temperatures taken in the deepest part of the loch on the date of the survey, the air-temperature being 53°, shows a range of 5·6° from surface to bottom, the greatest fall of temperature occurring beyond the depth of 100 feet—a fall equal to about 4° between 100 and 125 feet.

4. Lochs of the Hope Basin.

The only loch to be dealt with here is the large Loch Hope, one of the most important and the most northerly of the Sutherlandshire lochs. There are several small hill lochs within the basin, which could not be sounded at the time of the visit of the Lake Survey. The headwaters of the basin take their rise on the flanks of Ben Hee, of Meallan Liath, and of Meall Horn, whose summits attain heights exceeding 2500 feet. The total area of the basin is 75 square miles, of which nearly the whole drains into Loch Hope.

Loch Hope.—Loch Hope lies close to the eastern shore of Loch Eriboll

on the north coast of Scotland, at an elevation of only 12½ feet above sea-level, so that a slight subsidence would convert it into an arm of the sea and a branch of Loch Eriboll. The natives declare that the sea never enters the loch, though ordinary spring tides attain a point not more than half a mile from the foot of the loch, and at the upper end three terraces are to be seen, and traces perhaps of a fourth. Ben Hope rises very steeply to a height of over 3000 feet to the south-east of the head of the loch, and the ground further north and to the west, though not so high, is also steep close to the shore; some parts of the shores are well wooded. The loch is free from islands, but on the date of the survey a reputed old castle was just showing a few inches above the water about a mile from the foot of the loch. The trend of the loch is almost north and south, and the total length exceeds 6 miles. The two ends of the loch are narrow, but it broadens out in the central portion, where there is a maximum breadth of three-quarters of a mile; the mean breadth of the entire loch is over one-third of a mile. The waters of the loch cover an area exceeding 1500 acres, or 2⅓ square miles, and it drains an area exceeding 73 square miles. The maximum depth of 187 feet was observed about midway between the two ends of the loch. The volume of water is estimated at 4032 millions of cubic feet, and the mean depth at 61½ feet. The loch was surveyed on September 30, 1902, when the elevation of the lake-surface was found, by levelling from bench-mark, to be 12·55 feet above the sea; when levelled by the officers of the Ordnance Survey on August 9, 1858, the elevation was 12·3 feet above sea-level. The highest drift-mark observed was 9 feet above the surface of the water on the date of the survey, and, according to the local gillie, the water might fall 2 feet lower, giving a total range in level of about 11 feet.

The floor of Loch Hope is somewhat uneven. Proceeding from the lower (northern) end of the loch for a quarter of a mile, one meets with a small 25-feet area, based on soundings of 26, 30, and 32 feet, whence the bottom rises in the vicinity of the reputed old castle already mentioned, which lies towards the eastern shore; off the opposite shore in this locality there were many boulders in the water. Thence proceeding to the southwards, the water rapidly deepens until it attains a depth of 104 feet opposite the entrance of the Allt an Ruighein, about 1½ miles from the foot of the loch. Thence for a distance of about three-quarters of a mile the bottom rises again until the depth in the centre is 44 feet, with deeper water on both sides. This shoal coincides with a narrowing in the outline of the loch, whence to the south the loch broadens out and the water deepens so rapidly that at a distance of little more than half a mile from the 44-feet sounding the maximum depth of the loch (187 feet) is met with. A section across the loch in the position of the deepest sounding brings out some interesting points. From this position the bottom rises gradually, though irregularly, towards the head of the loch. A section down the centre of the loch along the axis of maximum depth brings out the salient features in the conformation of the lake-floor, but

gives no indication of some of the minor irregularities. For instance, the 44-feet shoal already referred to is not shown because a depth of 56 feet occurs nearer the western shore, nor another shoaling covered by 117 feet of water to the south of the deepest sounding. The off-shore slope is in some places rather steep—for instance, along the eastern shore, where off the entrance of the Allt a' Mhuilinn a sounding in 53 feet was taken about 60 feet from shore, and off the entrance of the Allt a' Phris Ghil a sounding in 28 feet was taken about 30 feet from shore; also along the western shore about 1½ miles from the head of the loch, where a sounding in 25 feet was taken about 30 feet from the shore.

Temperature Observations.—A series of temperatures taken at 3 P.M. on the date of the survey in the deepest part of the loch shows a range from surface to bottom amounting to 5·4°. The upper layers of water are practically uniform in temperature, the decrease from the surface down to 50 feet being only 0·6°, down to 100 feet 1·3°, and down to 120 feet 1·6°, whereas between the depths of 120 and 150 feet the fall of temperature was 3·8°. It was stated that the loch freezes all over in winter.

NOTES ON THE GEOLOGY OF THE DISTRICT BETWEEN LOCH HOPE AND STRATH NAVER.

By B. N. Peach, LL.D., F.R.S., and J. Horne, LL.D., F.R.S.

The district extending from Loch Hope to Strath Naver, in the north of Sutherland, has not yet been wholly mapped by the Geological Survey.

The north-western tract, embracing the lower part of Loch Hope, comes within the belt of territory affected by the Post-Cambrian movements to which reference has been made in the description of the geology of the districts of Loch Assynt and Loch Maree. Hence, on the hill slopes on either side of the river Hope we find various subdivisions of the Cambrian system, repeated by folds and reversed faults, and overlaid by slices of Archæan gneiss, which resemble portions of the old floor on which the Cambrian strata rest unconformably west of Loch Eriboll and the Kyle of Durness.

East of these displaced masses there is a great succession of crystalline schists stretching eastwards to Strath Naver, which, in the north of Sutherland, are everywhere separated from the rocks to the west by a powerful line of disruption, termed the Moine thrust. They consist of two main types—flaggy quartzose granulites and garnetiferous muscovite-biotite schists with intermediate varieties—the whole evidently representing an altered sedimentary series. Bands of garnetiferous hornblende-schist are intercalated in these granulitic schists, which are, without doubt, deformed intrusive sheets of igneous material. The lithological characters of the strata, the order of succession, and the peculiar system of folding are magnificently displayed on Ben Hope (3040 feet), where the divisional planes generally dip to the east-south-east at angles varying from 12° to 30°. But in addition to these members of the Moine series, which are now generally regarded as altered sediments, there are belts of massive, hornblendic, and micaceous gneisses resembling the Lewisian types in the north-west of Sutherland. The precise relationship of these two divisions of the crystalline schists has not been definitely ascertained in this district, but it is sufficiently clear that they have been affected

by a common system of folding, and in certain localities by common planes of schistosity. From the north coast, these massive basic and acid gneisses of Archæan type stretch southwards along the west side of the Borgie valley to Loch Creagach, near Loch Laoghal, and another belt of somewhat similar materials has been traced from the village of Tongue northwards by Ribigil to Loch an Dithreibh.

After the eastern schists had assumed their present crystalline characters, they were pierced by intrusive masses of granite, which form a picturesque group of peaks on Beinn Laoghal, south of Tongue. The mapping of that area leads to the conclusion that the granite there forms a great sill-like intrusion, which, on the north-east side of the loch of that name, branches off into minor sheets, or apophyses.

On the east side of the Kyle of Tongue there are various small outliers of Old Red Sandstone, largely composed of conglomerate, as, for instance, on Cnoc Creagach, on Beinn Bhreac, and on Cnoc an Fhreiceadain, which rest unconformably on the crystalline schists. They contain fragments of the various component members of the underlying platform, together with blocks of Cambrian quartzite and limestone.

Loch Hope.—The lower portion of this lake, measuring about 2 miles in length, is floored by thrust masses of Lewisian gneiss and deformed schistose rocks affected by the Post-Cambrian movements, while the lip of the basin, above the point where the Loch discharges into the river Hope, is composed of Lewisian gneiss on the east side and Cambrian quartzites on the west. No rock is visible at the mouth of the lake, nor in the course of the stream that connects it with the sea. On either side of the river Hope there are alluvial terraces, eroded partly out of solid rock and partly out of raised beach deposits. There are remains of the 100-feet beach by the river Hope, and of the 50-feet beach at the head of the lake; hence it is evident that during their deposition the sea must have extended far up the valley.

The lower portion of the lake lies along a line of fault trending nearly north and south, which is evidently continued northwards along the channel of the river Hope, though concealed by the alluvial deposits. On either side of this line there has been a lateral shift of the outcrops of the various groups of rock, indicating a downthrow to the east. This dislocation has been proved to traverse that portion of land that juts into the loch on the west side about a mile south of Poll Athroinn, where the quartzose flagstones of the Moine series have been thrown down against a narrow belt of deformed Lewisian gneiss. Though the whole of Strath Mor (the valley above Loch Hope) has not been mapped by the Geological Survey, it is not improbable, judging from the straight feature, that the fault may be prolonged southwards, and may have been a prominent factor in determining the original course of the valley.

Though no rock is seen at the outlet of the lake, it is not improbable that it may be a rock basin. Its widest and deepest part lies within the area occupied by the eastern or Moine schists (Geological Survey), just above the belts of displaced and deformed Lewisian gneisses and the crushed schistose rocks in association with them. Bounded by the 75-feet contour-line, this upper basin extends for 1½ miles above the narrows, with an average breadth of one-third of a mile. A second basin, with a maximum depth of 104 feet, occurs further down opposite Poll Ath-roinn, which is carved out of a belt of Lewisian gneiss and the mylonized rocks above the Moine thrust-plane.

As the surface of the water in Loch Hope is only 12 feet above sea-level, the greater part of the lake is below the level of the sea.

The striæ and the distribution of the drift indicate that during the early and later glaciations the ice moved from the south towards the north, so that the trend of the lake coincides generally with the direction of ice-movement.

Loch Laoghal, Loch Creagach, and Loch Slaim.—The rocks underlying this chain of lochs consist of hornblendic gneisses exposed on either side of Loch Slaim, of granulitic micaceous gneisses of the Moine series, and the granite of Beinn Laoghal and Beinn's Tomaine. Along the northern margin of this granite mass the strike of the schists is nearly east and west, the general dip of the foliation planes being towards the south at angles varying from 20° to 70°. These rocks are visible at certain localities on either side of Loch Creagach, and on the ridges east and west of the lower end of Loch Laoghal, where they pass underneath the sill-like mass of granite and its apophyses. For a distance of upwards of 2 miles from the foot of Loch Laoghal granite occurs on both banks of the lake, but in the southern portion the granite extends continuously along the west side, while the crystalline schists occur at intervals on the east side.

Though these three lakes are now separated from each other, they may be regarded as one sheet of water, as they are nearly at the same level. The strip between Loch Slaim and Loch Creagach consists partly of moraine matter and partly of the same material arranged in the form of terraces rising to about the 400-feet contour-line. The barrier between Lochs Creagach and Laoghal is composed partly of terraced morainic matter, partly of alluvium brought down by the stream draining the north slope of Beinn's Tomaine, and partly of gravelly material driven along the spit by the prevalent west wind.

An alluvial terrace, about the 400-feet level, connects the three lakes, thereby indicating that they must have been at one time continuous. This feature does not occur in the upper part of Loch Laoghal, where the unmodified moraines extend downwards to the present shore of the loch. It is not improbable, therefore, that the upper portion may have been occupied by a glacier while the barrier of moraines beyond Loch Slaim was being lowered.

But though these lakes are ponded back by moraines at the surface, it would appear that the lower portions of Loch Creagach and Loch Laoghal may be rock-basins, for at a distance of about 1½ miles below Loch Slaim the river Borgie flows over a rocky floor of hornblendic gneiss, at a height of 304 feet, while the surface-level of the two upper lochs is 369 feet. The difference between these elevations is 65 feet. On referring to a chart of the soundings, it will be seen that the greatest depth of Loch Creagach is 84 feet, of the lower basin of Loch Laoghal 217 feet, and of the upper basin 137 feet. If, then, we assume that the rocky barrier 1½ miles below Loch Slaim, near Dailaneas, crosses the valley at the same level (304 feet) underneath the drift, then it follows that the depth of water below the rocky barrier is in the case of Loch Creagach 19 feet, of the lower basin of Loch Laoghal 152 feet, and of the upper basin 72 feet. The deepest part of Loch Laoghal occurs where the valley is most constricted, and where the hills on either side are loftiest.

Although no glacial markings have been found in the immediate neighbourhood of the lochs, the striæ in the surrounding district show that the ice-movement during the period of maximum glaciation was slightly west of north. The dispersal of the boulders and the disposition of the moraines indicate that during the later glaciation a confluent glacier moved northwards from the interior, one branch skirting the western slope of Beinn Laoghal, a second passing through the hollow occupied by the loch of that name, and a third round the eastern slope of Beinn's Tomaine. The stages in the gradual retreat of the mass of ice that moved down

the valley of Loch Laoghal are clearly marked by a succession of moraine terraces, which enclose the small lochans shown on the chart to the east of Loch Creagach and Loch Slaim.

Loch an Dithreibh is a rock-basin lying in hornblendic and micaceous gneisses, whose strike is nearly north and south and nearly parallel to the direction of the lake. They are admirably exposed on the great crag on the east side of the loch. The solid rock is not exposed at the lip of the basin, but at a point in the stream about a quarter of a mile below the outlet at a height of 261 feet, the surface of the loch being 267 feet above sea-level, and the deepest part of the basin being 157 feet.

Loch Syre, like many of the lochans east of Loch Laoghal, is surrounded with morainic deposits.

NOTES ON THE BIOLOGY OF THE LOCHS OF NORTH SUTHERLANDSHIRE.

By James Murray.

Tow-nettings were taken in seven out of the eleven lochs included in this paper. These include three deep lochs (Hope, an Dithreibh, and Laoghal), and two very shallow lochs (Chaluim and na Meide), while Loch Naver is intermediate. The biological phenomena are in accordance with those differences, the plankton of the deep lakes being relatively poor, and similar to that of great lakes in general, the shallow lakes having a large admixture of littoral forms.

All the lochs were rich in algæ, especially Desmids, including many of those conspicuous species of western type, alluded to by Messrs. West, which are so characteristic of the extreme north-western fringe of Europe. The northern species of *Diaptomus*—*D. laciniatus*, *D. laticeps*, and *D. weirzejskii*– which are so widely distributed in the north of Scotland, Orkney, Shetland, and the western isles, and which are common in many lochs immediately adjacent, both to the east and south, are absent from most of the lochs of this district. *D. laticeps* is in Lochs na Meide and Naver, *D. laciniatus* in Loch na Meide only. *D. gracilis* is in six of the lochs, and in five it is the only species.

In the short list of organisms following the name of each loch, species of general distribution are omitted, only those being included which are interesting on account of their distribution or rarity.

Loch Hope.—*Leptodora*, *Daphnia hyalina* (head rounded), *Diaphanosoma*, *Floscularia pelagica*, *Triarthra longiseta*, *Clathrulina elegans*, *Micrasterias furcata*, *Staurastrum furcigerum*, *Xanthidium subhastiferum*.

Loch an Dithreibh.—*Bosmina obtusirostris*, var. *longispina*, *Floscularia pelagica*, *Staurastrum ophiura*, cysts of *Ceratium*. Animal life (both as to individuals and species) was very scarce, while the smaller algæ were conspicuous.

Loch na Meide.—*Diaptomus laticeps*, *D. laciniatus*, *Cyclops gigas*, *Daphnia* (*galatea*), *Ilyocryptus acutifrons*, *Gastropus stylifer* (= *Notus pygmæus*), *Staurastrum ophiura*, *S. arctiscon*, *S. pseudopelagicum*, *Micrasterias apiculata*, var. *fimbriata*. This loch was remarkable for the abundance of both animal and plant life ; about eighty species of organisms were found in the first cursory examination. The true plankton was not, however, particularly rich, there being a very large admixture of littoral species. *Ilyocryptus acutifrons* was first observed in Scotland in this loch, though it was afterwards found that it had been collected in Loch Shin at an earlier date.

Loch Naver.—*Diaptomus laticeps*, *Bosmina obtusirostris* (small, with long

spine, *Floscularia pelagica*, *Gastropus stylifer*, *Staurastrum ophiura*, *S. arctiscon*, *S. grande*, *Micrasterias conferta*, *M. furcata* typical, also a variety having the whole surface covered with hemispherical papillæ of unequal sizes).

Loch Chaluim.—*Daphnia* two forms, first with small rounded head, second with very large broad, depressed head, many males. *Synchæta pectinata*, *Gastropus stylifer*, *Polychætus collinsi*, *Staurastrum ophiura*, *S. arctiscon*, *S. furcigerum*.

Loch Laoghal.—*Bosmina obtusirostris*, var. *longispina*, *Floscularia pelagica*, *Triarthra longiseta*, *Clathrulina elegans*, *Staurastrum pseudopelagicum*, *S. jaculiferum*.

Loch Craagach is connected with Loch Laoghal by a wide channel, and stands at the same level. The biology calls for no separate mention.

Note on *Clathrulina elegans*, Cienk.—Skeletons of this animal were abundant in the deep lochs Hope and Laoghal. In an earlier paper of this series an attempt was made to account for the presence of these empty shells in so many of the Scottish lochs, and as a general rule only in large ones, on the supposition that they were derived from the shallow waters in which *C. elegans* is known to live, attached to water-plants by a slender stalk. Up till quite recently only empty cases had been found, or at most an occasional shell containing an encysted mass of protoplasm, and on these facts was based the suggestion put forward as to their origin. A fresh aspect is put upon the inquiry by the recent observation that in Loch Lochy, where the animal was abundant in August 1905, when the loch was visited in company of Prof. Bachmann, most of the shells contained living animals, which extended their pseudopodia and seemed quite at home. There was in no instance any trace of a stalk. These facts lead to the supposition that perhaps the lacustrine form may be a permanent pelagic race, or even a distinct species. Or it may be that the animal is attached when young, and becomes free when adult. There are difficulties in the way of accepting either hypothesis. If it be a true plankton form, we have to explain the absence of living animals from so many of the Scottish lochs in which the skeletons occur, and some of which have been examined at all seasons of the year. If it be a littoral form, and only casual in the plankton, it is still unexplained why the skeletons are, as a rule, only in large lakes.

PRELIMINARY REPORT OF THE SAN FRANCISCO EARTHQUAKE COMMISSION.

We have received the Preliminary Report issued by the "State Earthquake Investigation Committee," which was constituted by Mr. Geo. C. Pardee, Governor of the State of California, a few days after the great earthquake of April last at San Francisco. The Commission consists of the following persons:—Professor A. C. Lawson of the State University, Professor G. K. Gilbert of the United States Geological Survey, Professor Fielding Reid of Johns Hopkins University, Professor J. C. Branner of Stanford University, Professor A. O. Leuschner of the State University, Professor George Davidson of the State University, Professor Charles Burkhalter of the Chabot Observatory, and Professor William Wallace Campbell, Director of the Lick Observatory, Professor A. C. Lawson being chairman, and Prof. A. O. Leuschner secretary. The Report, after giving some account of the method of procedure adopted, the formation of

committees and so on, gives under the heading of "Results" the following paragraphs, which we quote in full :—

"One of the remarkable features of the Coast Ranges of California is a line of peculiar geomorphic expression which extends obliquely across the entire width of the mountainous belt from Mendocino County to Riverside County. The peculiarity of the surface features along this line lies in the fact that they are not due, as nearly all the other features of the mountains are, to atmospheric and stream erosion of the uplifted mass which constitutes the mountains, but have been formed by a dislocation of the earth's crust, or rather a series of such dislocations, in time past, with a differential movement of the parts on either side of the plane of rupture. In general this line follows a system of long narrow valleys, or where it passes through wide valleys it lies close to the base of the confining hills, and these have a very straight trend; in some places, however, it passes over mountain ridges, usually, at the divide separating the ends of two valleys; it even in some cases goes over a spur or shoulder of a mountain. Along this line are very commonly found abrupt changes in the normal slope of the valley sides giving rise to what are technically known as scarps. These scarps have the appearance of low precipitous walls which have been usually softened and rounded somewhat by the action of the weather. Small basins or ponds, many having no outlet, and some containing saline water, are of fairly frequent occurrence and they usually lie at the base of the small scarps. Trough-like depressions also occur bounded on both sides by scarps. These troughs and basins can only be explained as due to an actual subsidence of the ground, or to an uplift of the ground on one side or the other, or on both sides. The scarps similarly can only be ascribed to a rupture of the earth with a relative vertical displacement along the rupture plane. Frequently small knolls or sharp little ridges are found to characterise this line, and these are bounded on one side by a softened scarp and separated from the normal slope of the valley side by a line of depression. In many cases these features have been so modified and toned down by atmospheric attack that only the expert eye can recognise their abnormal character; but where their line traverses the more desert parts of the Coast Range, as for example in the Carissa Plains, they are well known to the people of the country, and the aggregate of the features is commonly referred to as the 'earthquake crack.'

"This line begins on the north at the mouth of Alder Creek near Point Arena, and extends south-easterly nearly parallel with the coastline to a point about two miles below Fort Ross, a distance of forty-three miles. Here it passes outside of the shoreline and is again met with at the point where Bodega Head joins the mainland. Thence it appears to continue southward through Tomales Bay and Bolinas Lagoon. Beyond Bolinas Lagoon it passes outside of the Golden Gate and enters the shore again at Mussel Rock, eight miles south of the Cliff House. From this point it is traceable continuously along the valley line occupied by San Andreas and Crystal Springs Lakes, past Woodside and Portola, over a saddle back of Black Mountain, thence along Stevens Creek Cañon, passing to the south-west of Table Mountain and Congress

Springs to the vicinity of Wrights, on the narrow-gauge railway between San José and Santa Cruz. From Wrights it continues on in the same course through the Santa Cruz Mountains to the point where the Southern Pacific Railway crosses the Pajaro River near Chittenden. From the crossing of the Pajaro the line extends up the valley of the San Benito River, across the eastern portion of Monterey County, and thence follows the north-eastern side of the valley of the San Juan River and the Carissa Plains to the vicinity of Mount Pinos, in Ventura County. The line thus traced from Point Arena to Mount Pinos has a length of 375 miles, is remarkably straight, and cuts obliquely across the entire breadth of the Coast Ranges. To the south of Mount Pinos the line either bends to the eastward, following the general curvature of the ranges, or is paralleled by a similar line offset from it *en echelon*; for similar features are reported at the Tejon Pass and traceable thence, though less continuously, across the Mojave Desert to Cajon Pass and beyond this to San Jacinto and the south-east border of the Colorado Desert. The probability is that there are two such lines, and that the main line traced from Point Arena to Mount Pinos is continued with the same general straight trend past San Fernando and along the base of the remarkably even fault scarp at the foot of which lies Lake Elsinore. But, leaving the southern extension of the line out of consideration as somewhat debatable, we have a very remarkable physiographic line extending from Point Arena to Mount Pinos, which affords every evidence of having been in past time a rift, or line of dislocation, of the earth's crust and of recurrent differential movement along the plane of rupture. The movements which have taken place along this line extend far back into the Quaternary period, as indicated by the major, well-degraded fault scarps and their associated valleys; but they have also occurred in quite recent times, as is indicated by the minor and still undegraded scarps. Probably every movement on this line produced an earthquake, the severity of which was proportionate to the amount of movement.

"The cause of these movements in general terms is that stresses are generated in the earth's crust which accumulate till they exceed the strength of the rocks composing the crust, and they find a relief in a sudden rupture. This establishes the plane of dislocation in the first instance, and in future movements the stresses have only to accumulate to the point of overcoming the friction on that plane, and any cementation that may have been effected in the intervals between movements.

"The earthquake of the 18th of April 1906 was due to one of these movements. The extent of the rift upon which the movement of that date took place is at the time of writing not fully known. It is, however, known from direct field observations that it extends certainly from the mouth of Alder Creek near Point Arena to the vicinity of San Juan in San Benito County, a distance of about 185 miles. The destruction at Petrolia and Ferndale in Humboldt County indicates that the movement on the rift extended at least as far as Cape Mendocino, though whether the line of rift lies inland or off shore in that region is still a matter of inquiry. Adding the inferred extension of the movement to

its observed extent gives us a total length of about three hundred miles. The general trend of this line is about N. 35° W., but in Sonoma and Mendocino counties it appears to have a slight concavity to the north-east, and if this curvature be maintained in its path beneath the waters of the Pacific it would pass very close to and possibly inside of Capes Gordo and Mendocino. Along the 185 miles of this rift where movement has actually been observed the displacement has been chiefly horizontal on a nearly vertical plane, and the country to the south-west of the rift has moved north-westerly relatively to the country on the north-east of the rift. By this it is not intended to imply that the north-east side was passive and the south-west side active in the movement. Most probably the two sides moved in opposite directions. The evidence of the rupture and of the differential movement along the line of rift is very clear and unequivocal. The surface soil presents a continuous furrow generally several feet wide with transverse cracks which show very plainly the effort of torsion within the zone of the movement. All fences, roads, stream courses, pipe lines, dams, conduits, and property lines which cross the rift are dislocated. The amount of dislocation varies. In several instances observed it does not exceed six feet. A more common measurement is eight to ten feet. In some cases as much as fifteen or sixteen feet of horizontal displacement has been observed, while in one case a roadway was found to have been differentially moved twenty feet. Probably the mean value for the amount of horizontal displacement along the rift line is about ten feet, and the variations from this are due to local causes such as drag of the mantle of soil upon the rocks, or the excessive movement of soft incoherent deposits. Besides this general horizontal displacement of about ten feet there is observable in Sonoma and Mendocino counties a differential vertical movement not exceeding four feet, so far as at present known, whereby the south-west side of the rift was raised relatively to the north-east side, so as to present a low scarp facing the north-east. This vertical movement diminishes to the south-east along the rift line, and in San Mateo County is scarcely, if at all, observable. Still farther south there are suggestions that this movement may have been in the reverse direction, but this needs further field study.

"As a consequence of the movement it is probable that the latitudes and longitudes of all points in the Coast Ranges have been permanently changed a few feet, and that the stations occupied by the Coast and Geodetic Survey in their triangulation work have been changed in position. It is hoped that a reoccupation of some of these stations by the Coast and Geodetic Survey may contribute data to the final estimate of the amount of movement.

"The great length of the rift upon which movement has occurred makes this earthquake unique. Such length implies great depth of rupture, and the study of the question of depth will, it is believed, contribute much to current geophysical conceptions.

"The time of the beginning of the earthquake as recorded in the Observatory at Berkeley was 5 hrs. 12 min. 6 sec. A.M., Pacific standard time. The end of the shock was 5 hrs. 13 min. 11 sec. A.M., the duration

being 1 min. 5 sec. Within an hour of the main shock twelve minor shocks were observed by Mr. S. Albrecht of the Observatory and their time accurately noted. Before 6 hrs. 52 min. P.M. of the same day thirty-one shocks were noted in addition to the main disturbance. These minor shocks continued for many days after April 18, and in this respect the earthquake accords in behaviour with other notable earthquakes in the past. The minor shocks which succeed the main one are interpreted generally as due to subordinate adjustments of the earth's crust in the tendency to reach equilibrium after the chief movement.

"The collection of time records necessarily proceeds slowly. The purpose of the coseismal curves based upon these records is in general two-fold. In ordinary earthquakes it is one of the means of locating the seat of the disturbance when there is no surface manifestation of the rupture in the earth's crust. In the present instance, however, the rupture has declared itself in an unmistakable rift observable at the surface, and coseismals are therefore unnecessary for the determination of this important factor in the general problem, so far at least as regards the main disturbance. It is probable, however, that so radical a change in the equilibrium of the stresses of the earth's crust would induce secondary ruptures and consequently secondary earthquakes closely associated with the chief shock. The careful plotting of the time records may, therefore, be useful in revealing the location of these secondary disturbances, such for example as the one which affected Southern California on the afternoon of the 18th of April. The second purpose of securing time records is the determination of the velocity of propagation of the earth wave; and the data for this which are likely to be most serviceable are the records obtained at various quite distant seismographic stations.

"The destructive effects of the earthquake are in the main distributed with reference to the line of rift. The exact limits of the area of destruction have not yet been mapped, but it is known to extend out about twenty-five or possibly thirty miles on either side of the rift. On the south-west side the greater part of this area to the north of the Golden Gate lies in the Pacific. This area extends from Eureka in Humboldt County to the southern extremity of Fresno County, a distance of about four hundred miles.

"Beyond this area of destructive shock the earthquake was felt in its milder manifestations over a wide territory. Our reports to date show that it was felt in Oregon as far north as Coos Bay and on the south as far as Los Angeles. To the east it was felt over the greater part of middle California and eastern Nevada, particularly along the eastern flank of the Sierra Nevada. It was felt at Lovelocks, and we have unconfirmed reports of its having been felt at Winnemucca. Far beyond the region within which it was apparent to the senses, however, the earth wave was propagated both through the earth and around its periphery; and some of the most valuable and most accurate records of the disturbance which we have are those which were registered at such distant seismographic stations as Washington, D.C.; Sitka, Alaska; Potsdam, Germany; and Tokyo, Japan.

"Within the area of destructive effects, approximately 400 by 50 miles in extent, the intensity varied greatly. There was a maximum immediately on the rift line. Water pipes, conduits, and bridges crossing this line were rent asunder. Trees were uprooted and thrown to the ground in large numbers. Some trees were snapped off, leaving their stumps standing, and others were split from the roots up. Buildings and other structures were in general violently thrown and otherwise wrecked, though some escaped with but slight damage. Fissures opened in the earth and closed again, and in one case reported a cow was engulfed. A second line of maximum destruction lies along the floor of the valley system of which the Bay of San Francisco is the most notable feature, and particularly in the Santa Rosa and Santa Clara valleys. Santa Rosa, situated twenty miles from the rift, was the most severely shaken town in the State and suffered the greatest disaster relatively to its population and extent. Healdsburg suffered to a nearly similar degree. San José, situated thirteen miles, and Agnews, about twelve miles from the rift, are next in the order of severity. Stanford University, seven miles from the rift, is probably to be placed in the same category. All of these places are situated on the valley floor and are underlain to a considerable depth by loose or but slightly coherent geological formations, and their position strongly suggests that the earth waves as propagated by such formations are much more destructive than the waves which are propagated by the firmer and highly elastic rocks of the adjoining hill lands. This suggestion is supported by a consideration of the destructive effects exhibited by towns and single buildings along the same valley line which are situated wholly or partly on rock. Petaluma and San Rafael, though nearer the rift than Santa Rosa, suffered notably less, and they are for the most part on, or close to, the rocky surface. The portions of Berkeley and Oakland which are situated on the alluvial slope suffered more than the foothills, where the buildings are founded on rock. The same suggestion is further supported from a consideration of the zone of maximum destructive effect on the south-west side of the rift. This zone lies in the Salinas Valley. The intensity of destructive action at Salinas was about the same as at San José, and the town is situated on the flood plain deposits of the Salinas River. Along the banks of the Salinas River and extending from Salinas to the vicinity of Gonzales, so far as our reports at present show, the bottom lands were more severely ruptured, fissured, and otherwise deformed than in any other portion of the State. The Spreckels Sugar Mill, situated on the banks of the river, suffered more severely probably than any other steel structure in the State. Santa Cruz, on the other hand, which is on the same side of the rift, and at the same distance from it, but which is built on rock for the most part, suffered much less damage. In the northern counties along the coast the most severe effects were felt at Ferndale, on the south margin of the flood plain of the Eel River, and at Petrolia, on the bottom land of the Mattole. Fort Bragg was severely shaken with very destructive effects, but our reports do not yet indicate the character of the ground upon which it is situated.

"In the facts which have been cited we seem to have warrant for a generalisation as to the excessively destructive effect of the earth wave as transmitted by the little-coherent formations of the valley bottoms. But it must be borne in mind that by far the greater number of structures subject to destructive shock are situated in the valley lands, and that there has not yet been time for a detailed comparison of the effects in the valleys with those in the hills, where the buildings are founded on firm rock, except in a few notable instances.

"The most instructive of these instances is the city of San Francisco, and the facts observed there are entirely in harmony with the generalisation above outlined. In the city of San Francisco we may recognise for preliminary purposes four types of ground: (1) The rocky hill slopes; (2) the valleys between the spurs of the hills which have been filled in slowly by natural processes; (3) the sand dunes; (4) the artificially filled land on the fringe of the city. Throughout the city we have a graded scale of intensity of destructive effects which corresponds closely to this classification of the ground. The most violent destruction of buildings, as everybody knows, was on the made ground. This ground seems to have behaved during the earthquake very much in the same way as jelly in a bowl, or as a semi-liquid material in a tank. The earth waves which pass through the highly elastic rocks swiftly with a small amplitude seem in this material to have been transformed into slow undulations of great amplitude which were excessively destructive. The filled-in material and the swampy foundation upon which it rests behaved, in other words, as a mass superimposed upon the earth's surface, rather than as a part of the elastic crust itself. In a less degree the same thing is true of the sand-dune areas, where the ground was frequently deformed and fissured. In still less degree the naturally filled valleys between the hill spurs were susceptible to this kind of movement, and the destruction of buildings was correspondingly less, but still severe, depending very largely on the character of the buildings, the integrity of their construction, etc. In portions of these valleys, however, the original surface of the ground has been modified by grading and filling, and on the filled areas the destruction was more thorough than elsewhere in the same valley tracts. On the rocky slopes and ridge tops, where, for the most part, the vibration communicated to buildings was that of the elastic underlying rocks, the destruction was at a minimum. On some of the hills chimneys fell very generally and walls were cracked; on others even the chimneys withstood the shock.

"While this correlation of intensity of destructive effect appears to hold as a generalisation, there are well-known exceptions which find their explanation in the strength of the structures. Modern class A steel structures with deep foundations appear to have been relatively passive, while the made ground in their immediate vicinity was profoundly disturbed. Thoroughly bonded and well cemented brick structures, on similarly deep and solid foundations, seem to have been equally competent to withstand the shock, except for occasional pier-like walls not well tied to the rest of the building. The weak points in wooden frame structures were in general the faulty underpinning and lack of

bracing, and chimneys entirely unadapted to resist such shocks. With these faults corrected, frame buildings of honest construction would suffer little damage beyond cracking of plaster in such a shock as the 18th of April, save on the made ground, where deep foundations and large mass appear to be essential for the necessary degree of passivity.

"Pipe lines and bridges crossing the rift line present a peculiar, if not quite unique, engineering problem which will doubtless be solved in the near future. Pipe lines on low swampy ground or in made ground are in much greater danger of destruction from earthquake shocks than those on high ground underlaid by rock, except in the immediate vicinity of the rift, where nothing could be constructed which would withstand the violence of the earth movement.

"One of the lessons of the earthquake which seems peculiarly impressive is the necessity for studying carefully the site of proposed costly public buildings where large numbers of people are likely to be congregated. In so far as possible such sites should be selected on slopes upon which sound rock foundation can be reached. It is probably in large measure due to the fact of their having such a rock foundation that the buildings of the State University, at Berkeley, escaped practically uninjured. The construction of such buildings as our public schools demands the most earnest attention of the people and of the authorities charged with their construction. A great many of our schools proved to be of flimsy construction and ill adapted to meet the emergency of an earthquake shock of even less severity than that of the 18th of April.

"The Commission, in presenting this brief report, has had in mind the demand on the part of the people of the State and of the world at large for reliable information as to the essential facts of the earthquake. It has, therefore, not presumed to engage in any discussion of the more abstruse geological questions which the event naturally raises. It leaves such discussion for a more exhaustive report which can only be prepared after the campaign of data collection is complete."

CONCERNING THE GREAT CALIFORNIAN DISASTER.

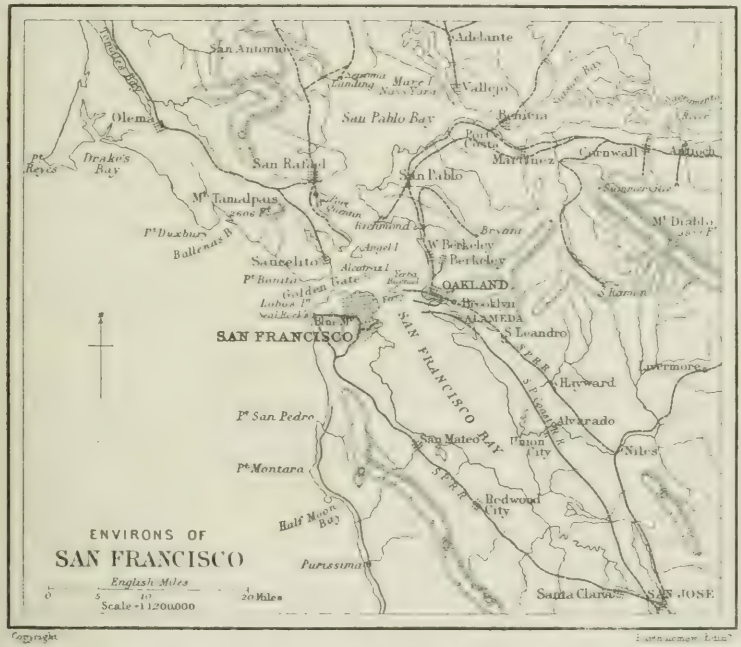
By James Main Dixon, M.A., F.R.S.E., Professor in the University of Southern California.

(*With Map.*)

The bold coastline of the Pacific stretching south from the Oregon State boundary is broken by one notable inlet, which provides the State of California with a magnificent natural harbour. As the vessels enter from the ocean, it is as if into the jaws of some great monster. The northern and southern cliffs of the Golden Gate form its upper and lower lips respectively; on the palate stand the cities of Point Richmond, Berkeley and Oakland; while the outer portion of the lower jaw is covered by San Francisco. Further along this jaw are San Mateo and several bay cities, the most notable of which is Palo Alto, where the Leland Stanford University is situated; while deep

in the gullet stands the "garden city" of San José, a place famous for its stoned fruits.

This great gullet is nearly fifty miles long, but averages little over eight miles in breadth. It has no tongue; unless we suppose Goat and Alcatraz islands to be the broken remnants of such a natural provision. The great Sacramento river pours its waters into the bay a few miles above the Golden Gate, creeping under the shadow of Tamalpais, the noble mountain that keeps watch over ocean, entrance and river, and enters the ocean to the north-west of the bay cities. There are few natural panoramas that can vie with the prospect from the top of Tamalpais. Mountain, valley, ravine, forest, river, shimmering bay



and boundless ocean spread in rich variety below; and often the white mist, rolling in, covers the further prospect and leaves the mountain like a pinnacle between cloudland and the blue heavens.

There is a comfortable hostelry near the summit, and a railway conducts visitors from the port below to the summit, the whole journey by ferry and rail from San Francisco and back taking but an afternoon. A singularly lurid prospect was presented to guests at the hostelry during the three fateful days in April when three-fourths of the city fell a prey to the flames.

San Francisco is a wind-swept city. Standing on a promontory but a few miles wide, and lying between the waters of the ocean and the waters of the bay, it cannot fail to be draughty. An observant visitor naturally remarks on the favourable conditions offered for a great conflagration. Probably nowhere in the world was there an abler or

more efficient fire brigade; and nowhere was an efficient fire brigade more needed.

Market Street might be termed the axis of the city. Beginning at the large Ferry Station, it ran uphill to the busy corner of Third Street, and continued its south-westerly course past the City Hall at Ninth Street. Here the main traffic was carried due westward along Hayes, M'Allister and Fulton Streets to the magnificent Golden Gate Park, the western edge of which faces the Pacific Ocean. Half a mile to the north stand the famous Cliff House and the Seal Rocks, a resort of all visitors. The whole length from the Ferry Station to the ocean beach is somewhat under five miles; to wit, three-quarters of a mile from the station to Third Street; a mile on to the City Hall; two miles by Fulton Street to the east end of the Park; and three miles through the length of the Park to the beach.

The quarter around the intersection of Market and Third Streets is the business heart of the city, and contained the lofty *Call* building, the *Examiner* and *Chronicle* buildings, the Palace, Grand, and Occidental Hotels, the Lick House, and the leading banks. Immediately to the west is Union Square, Stevenson's haunt when in the city. At its western end rose the lofty St. Francis Hotel, recently constructed at a cost of a million pounds sterling, and probably for its size the most costly edifice of the kind in existence. A block to the north stood the California Hotel, also a handsome structure; and the finest theatres lay between, in the shopping district.

On the west of the hill above Union Square, in the fashionable district, were found the Mark Hopkins Institute of Art, the gift of a wealthy San Franciscan, the mansions of the Crockers, Hoods, and other millionaires; and the palatial Fairmount Hotel, which was not yet completed at the time of the fire. On the north-east, covering the brow of the hill, was China Town, with its mysterious underground tunnels and nooks. Between China Town and the Ferry Station lay the busy market district, where the wholesale fruit, vegetable, cereal and other business of the city was transacted. Until a few months ago the Post Office quarters were in this district; but they were lately moved to a magnificent structure on Market Street, opposite to the City Hall. A mile south of Market Street stood the Southern Pacific Railroad Station, the northern terminus of the coast line leading through Palo Alto and San José to Monterey and Los Angeles.

To-day not one of these structures survives, and an area covering over six square miles, with Market Street as its diameter, is a charred mass of ruins. From China Town on the north to the Coast Line Station on the south, and from the Ferries on the east to the City Hall and the Post Office, all is desolation. Earthquake and fire have never joined to produce so fatal a holocaust.

But San Francisco was not the only place to suffer by the blow. The whole hundred miles from Santa Rosa on the north to San José on the south suffered more or less severely. Santa Rosa is a flourishing town of fifty thousand inhabitants lying on the rolling prairie stretching between the coast line of mountains and the ocean. Readers of

Stevenson's *Silverado Squatters* will remember his description of these precipitous regions where he spent his honeymoon among the clouds. The traveller who leaves Santa Rosa at breakfast-time will pass the "petrified forest" long before noon, and be able to lunch at "sleepy Calistoga"; and six miles more of uphill work will bring him to the old Silverado mine.

Santa Rosa is interesting in another connection. Here lived the prophet Harris who exercised so strange an influence over the personality of Laurence Oliphant. Harris founded a community in the place, and Oliphant brought his wife and his mother with him, where they worked like hired labourers. It is said that Harris is still alive in New York at the age of eighty-four; at any rate the Santa Rosa community lives on, mostly under the care of a Japanese convert. A dramatic quarrel took place nearly thirty years ago, when the Oliphants, losing faith in their leader, turned upon him with bitter accusations and were driven from his doors. Lady Oliphant, the mother, survived but a short time, and lies buried at Cloverdale, a short distance to the north.

Luther Burbank, the great horticulturist, resides at Santa Rosa, in a quiet cottage on the left bank. The main portion of the town, which is on the right bank, has suffered severely. All the large buildings are down, and half a hundred persons perished within the walls. Among the buildings wrecked is the pretty new Carnegie Library, built of stone.

Santa Rosa is the most northerly of the places which suffered; San José is the most southerly. It is a much busier centre than the other, with more ambitious structures. In the heart of the city is the large Normal School, a brick edifice, which succumbed to the shock. The Presbyterian Church also went down, with one of the large hotels, and the property loss is severe; but the loss of life is not so large, at least proportionately, as at Santa Rosa.

Twenty-three miles north of San José is Palo Alto, where the Stanfords built their beautiful University in honour of their dead boy. It has been one of the show places of the whole coast; a collection of stately brown-stone buildings in the Mexican style of architecture, equipped in the latest fashion for scientific and literary ends. Fourteen years ago these buildings consisted of but a single quadrangle of one story; and this is the only portion of the buildings which remains intact to-day. Around it clustered a two-storied range of buildings, with the exquisite Memorial Chapel at the western end. Within the quadrangle rose proudly a memorial arch. For some time back, two handsome buildings of considerable height have been going up to the left of the avenue leading up to the quadrangle—the new Library and the new Gymnasium. Both are shapeless ruins. The other buildings—the men's and women's dormitories, the Museum, the chemistry building—have all been more or less shattered; and two lives were lost in the catastrophe. The dome of the chapel fell in, wrecking the interior, and the arch was shattered. A million and a half pounds sterling will not repair the damage done.

Some loss was inflicted on the three cities across the bay from San Francisco—Berkeley, Oakland, and Alameda. Berkeley is the seat of the State University, and lies partly on a steep hill, and partly on made ground at the foot. The damage has been confined almost entirely to the lower portion, where the new High School stands. The University buildings occupy commanding sites on the steep slope leading up to Mount Grizzly; and they have escaped. The fine Greek Theatre, crowning all, and accommodating ten thousand people, at the upper end of the campus, is intact; so is the new Californian Hall, an Italian building in grey granite, completed only last year. The busy city of Oakland to the south escaped with a few broken chimneys; and Alameda in the flat beyond was equally fortunate.

All the earthquake loss fell on buildings occupying made ground. It was at one time reported that the Cliff House, built on a bold cliff facing the ocean, had fallen into the waves and been submerged; but the Cliff House is safe. Market Street practically followed a line of made ground; the streets to the north seem well fitted for tobogganing if the climate permitted the pastime. All the wrecked buildings at Santa Rosa and San José are on flat ground; the buildings of Leland Stanford University are not far from swamp land and occupy flat meadow ground.

Why, it may be asked, was the loss so great? Never before have so many square miles of the most valuable city property been so quickly reduced to ashes. It is certain that much of the loss must be ascribed to the escape of gas. Perhaps San Francisco and its suburbs have been using more gas for heating purposes, *per capita*, than any other cities in the world. Visitors have complained of the excessive use of these gas radiators, which make the air close and stifling. The climate is mild, and base-burners and furnaces are not a necessity. On chilly mornings a small gas-stove supplies all the heat demanded by many: and few are without a gas cooking-stove. The earthquake broke these gas-pipes and released the fluid; hence widespread fires resulted, for escaping gas will soon find a spark to set it ablaze. Electrical wires would also lose their insulation, and the combination presents frightful possibilities of disaster. The Call building, a lofty, tower-like structure, with steel frame, survived the earthquake to fall a victim to fire. The same fate befell the St. Francis Hotel. In most cases it was observed that the flames burst out in the uppermost floors. May it not have been that the gas-pipes there were subjected to a greater strain, and broke sooner?

It is likely that scientific men will bring in a heavy arraignment against the indiscriminate use of gas in crowded centres. Perhaps they will have something to say adverse to electricity. In these huge disasters, it happens that the servants whom man has called to his aid for a time seize the mastery. And then the faithless water failed the gallant firemen at their need, and made their fight a losing battle. The conditions were hopelessly against these brave men, who behaved like heroes, many dying at their posts. When the epic of this greatest of earthquake-conflagrations comes to be written, a fireman will be its Achilles.

THE SOUTHERN HIGHLANDS FROM GOUROCK.

By Frederick Mort, M.A., B.Sc., F.G.S., and John Frew, M.A.

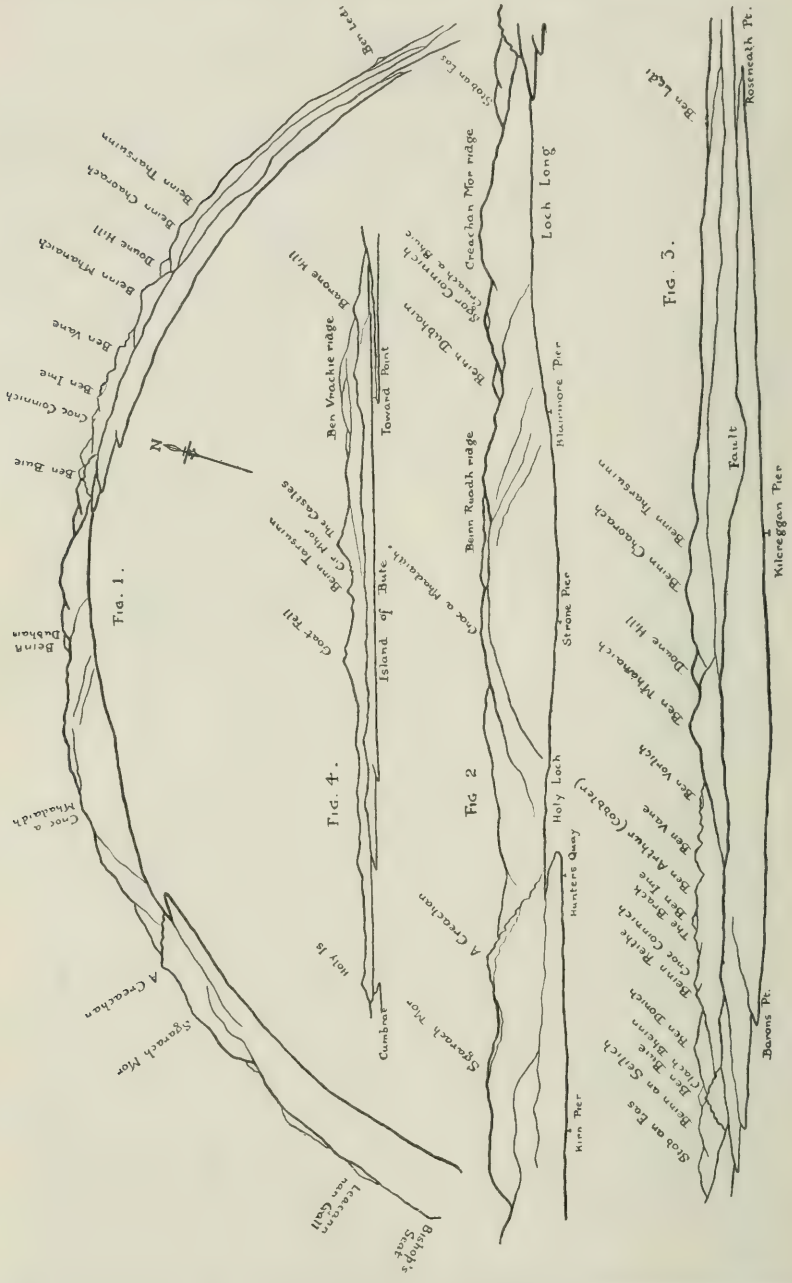
(*With Figures.*)

In the June number of this *Magazine* we gave and described drawings showing the aspects of the Southern Highlands from Dumgoyn, a hill in the north of the Clyde valley. If the observer changes his position to the south of the Clyde, he obtains quite a different view of the Highland peaks. The point from which the accompanying drawings were made is a hill about two miles south-west of Gourock. It is the 610 feet summit level shown on the ordnance maps just behind Leven Castle. From this point a magnificent sweep of coast-line can be observed, stretching from above Helensburgh, past Dunoon, to Toward Point. South of Toward Point, one looks right over Bute to Arran in the distance.

Name of Peak.	Angle.	Height in feet.
Ben Ledi,	2° 22′	2875
Beinn Tharsuinn,	23° 23′	2149
Beinn Chaorach,	25° 26′	2338
Doune Hill,	29° 5′	2409
Beinn Mhanaich,	32° 37′	2328
Ben Vorlich,	35° 40′	3092
Ben Vane,	37° 28′	3004
Ben Arthur,	39° 58′	2891
Ben Ime,	41° 21′	3318
The Brack,	42° 5′	2580
Cnoc Coinnich,	44° 20′	2497
Beinn Reithe,	45° 5′	2141
Ben Donich,	47° 41′	2774
Clach Bheinn,	49° 7′	1433
Ben Buie,	49° 16′	3106
Beinn an Seilich,	50° 42′	2359
Stob an Eas,	53° 15′	2400
Creachan Mor,	58° 39′	2156
Cruach a Bhuic,	62° 39′	2084
Beinn Dubhain,	66° 29′	2090
Beinn Ruadh,	73° 24′	2178
Cnoc a Mhadaidh,	79° 24′	1535
A Creachan,	93° 58′	1902
Sgarach Mor,	99° 21′	1972
Bishop's Seat,	124° 57′	1651
Barone Hill,	177°	532
The Castles,	188° 32′	2735
Cir Mhor,	189° 26′	2618
Beinn Tarsuinn,	190° 2′	2706
Goat Fell,	193° 28′	2866
Holy Island,	208° 30′	1030

As before all the angles shown were taken with a theodolite, and the contours of the hills are accurately copied from photographs. The true

angular relations of the various peaks and ranges are shown in Fig. 1.



The skyline of the observer is, of course, circular, and the observer's

position is the centre of the circle of which Fig. 1 is an arc. In order to obviate confusion in the drawings, we give the angles and heights of the various peaks in the foregoing table. All angles are measured from Roseneath Point.

Figs. 2 and 3 show the same hills as Fig. 1, on a scale about twice the size of that of Fig. 1.

The ridge from Bishop's Seat above Dunoon to Glen Lean in front of Sgarach Mor, is omitted in Fig. 2, as Bishop's Seat is the only feature of any importance. The most interesting mountain group shown in the drawings is undoubtedly the range behind Loch Long. Although few of the summits exceed 3000 feet in height, the mountains are so rugged in outline, the masses so justly proportioned, and the contours so varied, that they form as impressive a group as any in the country. The range subtends an angle of only 14°, but to the observer the mountains give the impression of stretching over a much greater extent.

Of this group of mountains, sometimes termed the "Alps of Arrochar," the highest and most imposing is Ben Ime. Both Ben Ime and Ben Vorlich are in the background, as is shown in Fig. 3. The line of the ridge just in front of them is shown in the drawing, but it may be quite imperceptible to the eye. Such also is the case with several other lines in the drawings. It is only in certain lights that they become visible. For example, on only one day of the three that we spent on the hill-top was it quite plain that Ben Reithe and Cnoc Coinnich were two distinct peaks, and not one. Of the two hills, Clach Bheinn and Ben Buie, Ben Buie is, of course, the more remote. Clach Bheinn is interesting, for it forms the most southerly and best known point of Ardkinglas, the estate just presented to Glasgow for the benefit of the citizens. Most of the important Perthshire mountains are completely cut off by the high ridges in the foreground. It is only where these diminish towards the east that Ben Ledi becomes visible.

One of the most interesting features of the landscape is seen in the drawings just east of Kilcreggan Pier. A distinct notch cuts into the low range of hills behind Kilcreggan. This is the groove caused by the great fault that runs right across Scotland. This great crack separates the Highlands from the Lowlands, all the rocks to the north belonging to the Highland schist series.

No one can fail to be struck by the great differences of outline of many of the ridges. All the foreground is occupied by low ranges of smooth and rounded contours, the profiles of which sweep down in softly flowing curves to meet the sea. From A Creachan behind the Holy Loch, however, over Ardkinglas estate right on to Ben Vorlich, the ranges are altogether different. Rough and gnarled, with jagged and serrated peaks, they form an ideal background to one of the finest views in Scotland. The explanation of this striking contrast is not difficult. The rocks in the foreground are comparatively soft and therefore weather with rounded outlines. Behind them there runs from south-west to north-east a band of hard, tough, pebbly grits which by their weathering give rise to the imposing outlines of Argyle's Bowling Green and the "Arrochar Alps." The district is also traversed by numerous lines

along which considerable crushing has taken place. The broken rock is easily removed by weathering and the resulting features add largely to the tumbled, rugged appearance of this area.

The old Highland plateau can be splendidly seen from the high ground behind Greenock or Gourock. Sir Archibald Geikie in *The Scenery of Scotland* recommends the hills behind Greenock as one of the best spots from which to obtain a good view of the Highlands. A glance at Figs. 2 and 3 shows that a ruler could almost be laid right along the tops of the mountains. As we pointed out in our last paper, the mountains are merely the last remnants of an old table-land.

In Fig. 4 Arran is shown on exactly the same scale as Figs. 2 and 3. Its insignificant size is of course due to its much greater distance. In the foreground the Island of Bute is seen. Looking at its true proportions (the vertical scale is the same as the horizontal) it is not difficult to understand how, at one time, the glaciers from the gathering grounds in the north flowed completely over Bute. The drawing is instructive in showing the marked contrast between this view of Arran and the much more familiar one from the east. With the latter view in the mind's eye, the distance of Holy Island from Goat Fell is rather surprising. Owing to the greater distance of Goat Fell from the point of observation, it is dwarfed both in height and bulk by the main peak of the Castles. Although the serrated outline of the skyline at Cir Mhor seems quite continuous, the peaks forming the notches there are really at very different distances from the eye.

GEOGRAPHICAL NOTES.

Europe.

Earthquake in South Wales.—An earthquake shock was felt on June 27 over a large area extending from Flintshire on the north to Plymouth on the south, and from Pembrokeshire on the west to Bath, Bristol, and Birmingham on the east. The length of the tremors is variously given as from two to ten seconds, and although a good deal of alarm was caused, especially in the mining districts of Glamorganshire, no serious damage is reported.

At Cardiff the shock was felt at about 9.50. It was preceded by a noise like the rumbling of a passing train, and lasted from eight to ten seconds. The severest tremors were felt at the docks.

At Swansea at 9.44 the people were alarmed by a noise as of a tremendous explosion, and this was immediately succeeded by a violent shock, which lasted two seconds. Pediments fell from the General Post Office and other public buildings, and hundreds of chimneys collapsed, some through roofs and others on to the pavements. In some of the streets the fall was so abundant that cartloads of bricks had afterwards to be removed. It was remarkable that, notwithstanding the widespread fall of débris at a time when the streets were full of people going to business, there was no case of serious injury.

Tremors of less severity were felt in Pembrokeshire, and also at several places in Mid-Wales—Llandilo, Llandrindod Wells, and Knighton. There are also reports of shocks from South Shropshire and Holywell (Flintshire), and so far from the centre of the disturbance as Witton, near Birmingham, where four distinct oscillations from east to east were experienced. The earthquake was distinctly perceptible at Abergavenny, Bath, Weston-super-Mare, and Bristol, especially in the neighbourhood of Bristol docks; and there are messages from Tavistock, Ilfracombe, Lundy Island, and Plymouth to say that the tremors were felt there, though at Plymouth they were at first thought to be due to heavy gun practice at the forts.

The weather in the districts affected was oppressive and the sky was overcast. Professor Milne states that he has no record at Newport (Isle of Wight) of the earthquake. In his opinion, it was traceable to yieldings on the lines of faults—that is to say, settlements or adjustments. The disturbed area is estimated by Dr. Dawson as measuring about 60,000 sq. miles, and he believes that the earthquake was a typical twin shock, the foci being probably coincident with an east and west fault passing close to Llanelly, Swansea, and Neath.

Other earthquake shocks were felt in Lancashire and Cheshire on June 28, and at Croydon on June 29.

Asia.

The Indian Government Mission to Eastern Turkestan.—According to a *Times* article, communications have been received from Dr. M. A. Stein, the leader of this expedition (cf. *S.G.M.*, p. 379). Dr. Stein writes from Sarhad, Wakhan, May 19. Having started from the Swat border, he managed to cross the Lowarai Pass safely on May 4. This year's snowfall has been abnormally heavy in the whole Hindu Kush region, and the Lowarai Pass (10,200 feet above the sea), exceptionally difficult at all times in the spring, owing to its narrow, avalanche-swept approaches, is likely to remain closed this year for ordinary traffic far longer than usual. Though Dr. Stein's marches through the valleys of Chitral and Mastuj to the Oxus had to be very rapid, he had plentiful opportunities for interesting antiquarian and ethnographical observations in a mountain region that has preserved much of old-world lore and races in its rugged isolation. In the main Chitral Valley he obtained records of several ancient Buddhist rock carvings with inscriptions, and found much of ancient Indian architectural ornament surviving in the wood carving of houses, etc. There, as well as in the still more confined Yarkhun Valley, he traced a number of pre-Mohammedan sites, including that of the old chief settlement of Mastuj which early Chinese annals mention. It was of distinct geographical interest, Dr. Stein states, to note how the incipient pressure of population, due to the *pax Britannica* and more settled conditions, is leading to the reoccupation of arable patches of land in elevated parts of these barren and narrow valleys, where cultivation had ceased for long centuries, partly, perhaps,

owing to the advance of glaciers and the consequent increased rigour of climatic conditions.

By its position between the racial area of India and Iran, and owing to the safe shelter its rugged mountains have afforded from very early times to tribes driven back and gradually absorbed elsewhere, Chitral is a very important field to the ethnographer. Thanks to the ready co-operation of the Mehtar, Dr. Stein succeeded in collecting a good deal of exact anthropological measurements from typical representatives of the races now settled in these valleys, including colonies of Keffirs and Hill-Tajiks (Galchas) from across the Hindu Kush watershed. The affinity between the "Dards" of Chitral and the Iranian hill tribes on the upper Oxus seems as marked in racial characteristics as in linguistic respects.

In order to trace on the spot the route followed by a Chinese force which in 749 A.D., operating from Kashgar and the Pamirs, succeeded in invading Yasin and Gilgit in spite of the formidable natural obstacles, Dr. Stein ascended to the Darkot Pass (about 15,400 feet above the sea). The topographical details preserved of that military exploit, justly famous in Chinese annals, were found to agree remarkably well with the route leading from Sarhad, on the Oxus, across the Baroghil saddle to the Darkot Pass. But his visit to the latter was made rather trying by the exceptionally heavy masses of snow overlying the great glacier over which the ascent leads. The route never opens before June, and this year is likely to remain impracticable much longer. The imposing glaciers descending into the uppermost part of the Yarkhun Valley seem to be all on the advance. Heavy and soft snow would have made the crossing of the Baroghil Pass with laden animals distinctly difficult but for the ready help of the Afghan authorities from the Wakhan side. Arriving on May 19 at Sarhad, Dr. Stein was received in the friendliest fashion by the colonel commanding the troops in Badakhshan and Wakhan, who, under the Ameer's special orders, had proceeded here to facilitate his onward journey across the Afghan Pamirs to the Tagh-dumbash.

Everything, Dr. Stein states, seems to indicate a desire on the part of the Kabul Government to prove on this occasion attentive and helpful to a traveller crossing its territory under the auspices of the Government of India. Even in this elevated mountain tract the early Chinese records permit interesting facts of historical geography to be traced with relative ease.

Africa.

Survey of Northern Nigeria.—Captain R. Ommanney, R.E., and Captain G. F. Evans, R.E., returned to England at the end of June on completion of the telegraphic longitude work for which they were sent to Northern Nigeria last autumn. Starting at Lagos in the middle of November 1905, the expedition worked up the telegraphic line *via* Jebba and Lokoja, and then along the line which goes through Zunguru and Zaria to Kano. Working eastwards, Leri and Bauchi were fixed, and on the return journey the telegraph line along the River Benne was used to

determine the positions of Ibi, Keffi, and Loko. In all the longitudes of fifteen important towns in Nigeria were determined with reference to Lagos, the longitude of which had already been fixed by cable from Cape Town. The mission involved a march of about 2000 miles and much arduous work.

Polar.

The Wellman Polar Expedition.—This expedition is now under way, Mr. Wellman and his party with the airship having sailed from Antwerp for Norway on June 16. The airship has been named the *United States*, and from Tromsoe, which was reached at the end of June, was conveyed to Magdalena Bay (Danes Island), lat. 79° 40′ N., in the steamer *Frithjof*, which has been put at Mr. Wellman's disposal by the American Government. At Danes Island a station with a shed to house the airship was previously established under the superintendence of Major Hersey of the United States Weather Bureau, who represents the United States Government and the National Geographic Society in the expedition. It was expected at the time of writing that the month of July would be required for the preliminary experiments, and the intention, if conditions are favourable, is to make a start for the Pole in August. A wireless telegraphy system has been established between Hammerfest and Danes Island, while meteorological observations are also to be made by the expedition. The pilot of the balloon is to be M. Hervieux, the well-known French aeronaut, and Mr. Wellman is also to be accompanied by Major Hersey and two Norwegian sailors. The following details may serve to give some idea of the size and nature of the *United States*.

The airship has a lifting power of no less than 16,000 lbs., the weight of the ship, its machinery, and appliances being only half that amount, thus leaving a balance of 8000 lbs. for crew and cargo. Heretofore all airships have been built for high speed at short distances, while this ship has been built for moderate speed and for a long radius of action. Unlike any previous airship, the *United States* will carry 5500 lbs. of petrol, sufficient fuel for a voyage of 1800 miles, these calculations being again based on the prevalence of calm.

The total length of the car of the airship, which is constructed of wood strengthened by steel, is 52½ feet, while its width is 6 feet. What may be described as the deck is divided into three sections, the centre portion being occupied by a basket-work cabin, 12 feet in length and 7 feet high, which will be the living and sleeping quarters of all on board. This will also contain, in addition to the cooking apparatus, the whole of the stores, clothes, and instruments of the expedition.

The motor power of the airship consists of two motors, one of 55, the other of 25 horse-power. The first will drive the forward screw, which is 18½ feet in diameter, 280 turns per minute, while the latter drives the rear screw (14½ feet in diameter) 350 turns per minute. Either may be worked alone or both together. The larger one is calculated to give a speed of 12 miles per hour, and both together 18 miles

per hour. The total crew of the airship will be five men, of whom three will always be on duty. One of these will be stationed on the navigating deck, where he works the rudder and watches the instruments, one in the engine-room, and the third will be on duty in the basket below the car, occupied in working the windlass, which operates the drag-anchor and the guide-rope. It is not calculated that any of the crew will be able to get more than three or four hours' sleep per day. The plan is that the airship shall not rise to a greater average height than 400 feet to 500 feet.

While the plan is to return from the Pole to Spitzbergen, if, on reaching the Pole, it is found that the wind should be unfavourable to that course, the explorers are prepared, in case strong wind should drive them to Siberia, British North America, Alaska, or Greenland, to follow the line of least resistance and go with the wind. Should they descend at either of these points, they are equipped with the fullest information, which has been collected for them by the Canadian, United States, Danish, Russian, and other geographical societies, as to the location of tribes, game, and supplies. It will thus be seen that Mr. Wellman contemplates the possibility of sailing right across the Arctic Ocean from land to land. Should any disaster happen to the airship, the expedition will resolve itself into a sledging party, the sledges, of which six will be carried on the airship, being drawn by two motor sledges, each of six horse-power. These motor-sledges were designed by Mr. Wellman, and based upon his former experiences with dog-sledging in the Arctic. They are constructed on the principle of a motor-cycle, weigh only 200 lbs. each, and are thus capable of being lifted by two men over the rough ice. In addition, the airship will carry a light steel boat, 16 feet long and 5 feet broad, which will be employed for crossing open water.

Food, which will be of a total weight of 800 lbs., contained in a small box of 16 cubic feet, and sufficient for the whole party for 75 days, will be carried in the little cabin of the airship.

International Congress for the Study of Polar Regions.—We have received an intimation to the effect that an International Congress for the Study of Polar Regions will be held in Brussels during the month of September next, and a cordial invitation is sent to the members of the Royal Scottish Geographical Society to be present at the Congress and take part in its Proceedings.

General.

Vacation Course in Geography at Oxford.—We have received a further circular in regard to this course (cf. p. 162). The circular states that the course, while primarily intended for teachers, will be found useful to others whose work has geographical aspects. Lectures and map demonstrations will be given in the School of Geography for about four hours each morning. There will also be demonstrations of methods of surveying and map-drawing in the field, and excursions to places of special geographical interest—one of these excursions will be

to a more distant district and take up a whole day. A few evening meetings will be arranged for discussions, especially on the teaching of geography.

Certificates of attendance will be granted to those who go through the full course.

Geographical Exhibition in Edinburgh.—An interesting exhibition of apparatus useful in the teaching of Regional Geography was held in the Outlook Tower, Edinburgh, from July 6 to 14. The exhibition had special reference to the region immediately round Edinburgh, and was intended to show teachers and others interested both what is being done and what can be done to utilise the resources of the district as an introduction to the study of Regional Geography. Included in it were models of the Edinburgh district, collections of maps and plans, and also of pictures, slides, and photographs, together with examples of various kinds of apparatus intended for teaching the main facts as regards meteorology and elementary astronomy. Especially striking were a series of fine photographs of the district lent by the Geological Survey, while the examples of pupils' work shown by the training colleges and schools aroused great interest. The exhibition, which was held under the auspices of the Outlook Tower Committee, should have a markedly stimulating effect on the teaching of Geography in Edinburgh, and on the movement for the establishment of a Chair of Geography in the University. The exhibition was opened by Professor Darroch, of the University of Edinburgh, whose address on the occasion we hope to publish here.

NEW BOOKS.

EUROPE.

By-Paths in the Balkans. By Captain W. V. Herbert. London: Chapman and Hall, 1906. *Price* 10*s.* 6*d.*

The title is no misnomer. It does not appear that the author knows the Balkans in their length and breadth. We should say he does not, judging from the references, but few, he makes to Albania, Macedonia, Montenegro, Bosnia, and Herzegovina. But he knows one part well, Bulgaria, and probably also Thrace: he has caught the spirit of the place and the people. He is not likely to please the new reviewers, for he represents a deeper, truer order of travellers and observers than those they praise. It is treason nowadays to say a word in appreciation of Turkish style or character. The modern world as a rule cries out in unreasoning prejudice, "Down with Turkey and Abdul the Damned!" But there are many things admirable and superior among the Turks; and it is significant that those who know them best like them best. It is only the new man out for a jaunt to catch pictures for his newspaper, or the political partisan out for some purely party purpose, who reports that everything Turkish is bad.

One of those who fought under Osman Pasha in the ever-memorable defence of Plevna, our author knows Turkish grit, physical and moral, too well ever to minimise the Turks; and all his experience since of other wars and peoples has

not changed his opinion. Was it not our chief Boer War hero, Sir George White, when Governor of Gibraltar, who declared that the Turks were the grandest military material in the world?

Our author does not deny that the Bulgarians are thoroughly in earnest about their army, and very thorough too—and he as a soldier should know—although he deplores a general lack of intelligence; but he shows most conclusively how hopelessly outnumbered they would be in a war with Turkey.

It did not require much knowledge of the Balkans to foretell the failure of the Mürrsteg programme, but even that was awanting both in the Concert of Europe and in the Press. The great mistake made is to ignore Turkey's preponderance, while the fact remains that the various peoples, differing in race, creed, language, aims, are more Turkish than they are anything else that is common to them. To put it otherwise, the only unifying element throughout is the Turkish—Turkish sentiment and ways, and largely also Turkish language and religion. Everything else is split on the rock of rival ambitions—Greek, Roumanian, Bulgarian, Albanian, and so forth.

Even Mr. Brailsford sees this now very clearly (as his book shows), though like others he did not see it when he first went out.

No solution can possibly be satisfactory that ignores the Turkish factor as the main one, or that has the "bag and baggage" policy chiefly in view.

It is, however, less with the political than with the social and romantic aspects of life in the Near East that our author is concerned. His book is very readable and highly entertaining. He may be rather more retrospective and also introspective than the public cares for; but none the less he is true to the sentiment of his subjects, and does what most recent writers fail to do, takes you with him into the weirdness and terror, the glamour and passion of life in the Balkans. This alone, apart from the merit of his many acute observations and comparisons of the various powers and influences working and scheming to outrival each other there, should ensure him many delighted readers.

His chapters, "The Watchtower," and "Stranded," even though we suspect them to be a little too highly coloured, are fine examples both of his style and of how romance and tragedy are never far away from reality in those lands.

Das Moselgebiet. Ergebnisse der Untersuchung der Hochwasserverhältnisse im Deutschen Rheingebiet. Bearbeitet und herausgegeben von dem Zentralbureau für Meteorologie und Hydrographie im Grossherzogtum Baden. VII. Heft. Berlin: Wilhelm Ernst und Sohn, 1905.

This volume is the report of an Imperial Commission to inquire into the conditions affecting the upper waters of the Rhine and its tributaries, especially with regard to the water supply of the various Rhine countries. The investigations have been of a most exhaustive character, and observations are recorded dealing with all the causes affecting the water-flow of the Moselle Basin. All the various sources and tributaries are catalogued, and their catchment areas and volume of water duly noted. Statistical tables give full data regarding seasonal rainfall, land surface vegetation and relief, geology, gradient and flow of streams, seasonal variation in volume of water and other information bearing on the question of water supply. The work is effectively illustrated by a series of beautifully executed maps and diagrams showing the orography, geology, forests, rainfall, etc. As a monograph in physical geography the report is a model piece of work which we should be glad to see done for the rivers of our own country.

Great Britain: Handbook for Travellers. By K. Baedeker. With twenty-two Maps, fifty-eight Plans, and a Panorama. Sixth Edition, revised and augmented. Pp. lxvi + 606. London: Dulau and Company, 1906. *Price* 10*s.*

The new edition of Baedeker's *Great Britain* bears evidence of careful and thorough revision, so far as we have checked it for our own area. Our only criticism would be that 73 pages out of 606 is but a scant share to devote to all the attractions of Scotland. Several valuable new maps and plans have been added, including a map of Scotland, which is a great improvement on the old one. The Shetland Isles may reasonably lay claim to a grievance, inasmuch as they are not shown on any of the maps, although they are dealt with in the text.

ASIA.

A Summer Ride through Western Tibet. By Jane E. Duncan. London: Smith, Elder and Co., 1906. *Price* 14*s.*

This interesting and pleasantly written work is the record of a tour in Little Tibet during the year in which Sir Frank Younghusband's expedition was making its way to Lhasa, the holy city of Tibet; and when we remember the alarming rumours which were prevalent at that time, we must recognise that it required no small courage on the part of Miss Duncan to start off alone on a tour through a region, at all times difficult and indeed dangerous, but which in the summer and autumn of 1904 was supposed to be unusually dangerous.

Miss Duncan left Srinagar in Kashmir in the end of May 1904 with the intention of making her way to Leh, and, if possible, to the Pang Kong lake, and thence back through Leh to Khapulla and Skardo, where she meant to turn south and return to Srinagar, traversing the Deosai plateau. Her programme was carried out in its entirety, and she is to be heartily congratulated on her success. From first to last she was never in personal danger from the inhabitants, and even in tracts where ladies had never ventured before she was welcomed with effusion, and seems to have had a very amusing and happy time. Like all English travellers she was credited with the powers of a physician, and in this capacity she was welcome everywhere. For a so arduous and nerve-trying journey she had many special qualifications, not the least fortunate and useful of which was that she was never troubled with mountain sickness. Crossing the Chang La Pass, which is some 18,000 feet above the level of the sea, where "even hill ponies sometimes spin round and drop down dead," she was in the saddle for 7½ hours continuously without feeling tired. She had arranged her journey so as to be in time to see the dance of the masked Lamas at Himis, and she was fortunate in seeing it under the most comfortable conditions, for the British Commissioner of Leh was present with a number of European guests; and in addition to the Lama dance there were other festivities distinctive of and peculiar to the locality. In the course of her wanderings Miss Duncan gave much attention to the subject of archæological remains and inscriptions, and a valuable feature of her book is that she indicates various places where such archæological and antiquarian treasures are likely to be found. There is also a very interesting chapter on Tibetan music and poetry. Some of the songs have been harmonised by the Rev. Mr. Francke, and on the piano sound plaintive and melodious. The "Summer Ride" occupied only a few months, but these were sufficient for a traveller of Miss Duncan's experience and powers of observation to gather much information and to form useful independent opinions regarding the condition, customs, religion, etc., of the people with whom she came in contact. We must add that the book is illustrated with

a great number of beautiful photographs, some of them taken by Miss Duncan herself, and it is equipped with an excellent map showing her route and the adjacent country. We may note that the title of the book is somewhat misleading, as the author never seems to have crossed the line separating the British and Chinese spheres of influence, and was thus never in Western Tibet proper.

In and Out of Chanda. By the Rev. Alex. Wood. Edinburgh: The Foreign Mission Board, 1906.

This little book contains an account of the Chanda Mission, as well as some translations of Indian folk-lore stories, and has a preface by the Bishop of St. Andrews. The attitude towards native customs and beliefs is somewhat conventional, and the appeal is hardly to a geographical audience as such.

In Anatolia. By Lambert Vannutelli. With 77 Illustrations and 4 Maps. Pp. 374. Rome: La Società Geographica Italiana, 1905.

This is a report of a mission in the interests of commercial geography sent by the Italian Geographical Society to the northern vilayets of Asia Minor, between April and August 1904. The task imposed upon Lieutenant Vannutelli was far from easy, owing to the difficulty of getting accurate and reliable statistics in a country like Turkey. The time at his disposal was also very short, but he has made the most of it, and his labours have resulted in an admirable report. This is divided into seven chapters, in which he treats of:—the conditions which the country presents in relation to commerce; Constantinople and the new German centre, Port Haidar Pasha, on the opposite side of the Straits; the principal centres on the Anatolian coast and Sea of Marmora; the centres along the south coast of the Black Sea; the principal centres in the interior; foreign economic activity, and the chief forms of employment of foreign capital in the Ottoman Empire; the actual situation of Italian commercial interests, with a *resumé* of the author's ideas and impressions. The volume contains a great number of useful statistical tables, and from one of these it will be seen that British trade, both as regards imports and exports, is still ahead of every other country.

AFRICA.

With Flashlight and Rifle: a Record of Hunting Adventures and of Studies in Wild Life in Equatorial East Africa. By C. G. Schillings. Translated by Frederic Whyte. London: Hutchinson and Co., 1906.

These two beautifully illustrated and interesting volumes by Herr Schillings deal with sport and natural history in German East Africa, and more particularly in the regions around Kilimanjaro. They will, of course, appeal in the first instance to the sportsmen of every country, and by them, unanimously and with good reason, they will be pronounced the best book on sport of this season. But we believe they will successfully appeal to a very much wider circle of readers, and it is to be hoped that their appeal will not be in vain. We are naturally distrustful of a book avowedly written with an object; but the object of Herr Schillings in this work is one which cannot fail to commend itself to all, except perhaps a few Philistines, whose wishes deserve no consideration. Herr Schillings pleads for the adoption of measures which will prevent the systematic and wholesale destruction of the big game of Africa—a destruction which he shows is going on with pitiful rapidity and disastrous results, without any corresponding advantage to

the public. Herr Schillings speaks with authority, the authority of one who knows thoroughly the subject he has taken in hand—the authority of an enthusiastic and experienced sportsman, who is at the same time a sincere lover of animals, and the authority of a man of science. But he is not unreasonable in his contentions, and he quite recognises that with the spread of colonisation and the growth of civilisation the area which can be assigned to the elephant, rhinoceros, lion, and other big game of Africa and elsewhere must necessarily diminish. What he eloquently and convincingly denounces is the wholesale destruction of big game either for the wretched boast of a "record bag," or for the sake of filthy lucre. "The way," he says, "in which wild life is annihilated nowadays in South Africa is simply terrible. A short time ago there were countless herds of splendid animals in Cape Colony. The Boers, trekking into the interior, had to fight their way step by step by slaughtering the animals they found grazing in their path. Civilisation brought about only the checking of the growth of the native races, not their extermination, like the American Indians. And the natives applied themselves to the work of destroying the wild life with the help of the arms brought in by the Europeans, and on behalf of the white traders who equipped them for the purpose. Thus disappeared the white-tailed gnu, the bontebok, the blesbok, the true quagga, the mountain zebra, the splendid roan antelope, the Cape buffalo, the elephant, the so-called white rhinoceros, the giraffe, the hippopotamus, and the ostrich—except for a few preserved individuals in the case of the first three, completely in the case of all the others. The number of animals still to be found there in the last third of the previous century was immense, but it is hard to realise the dense crowds of them that must have existed there a century before that. And side by side with them from earliest times lived the coloured races. Like the American Indians, they levied their toll upon the animal kingdom without impairing it. It was left to the reckless and purposeless slaughtering indulged in by civilised man to achieve the seemingly impossible, and turn this thickly inhabited region into a desert." It is some small satisfaction to know that, even at the eleventh hour, the senseless destruction of the animals has arrested the attention of both the German and the British governments, and that some measures have been taken to put a stop to indiscriminate slaughter, and to establish "sanctuaries" where some of the big game will have a chance of living unmolested and safe from the rifle, the poisoned arrow, and the deadly pit.

Herr Schillings in these volumes does not present to his readers a consecutive account of the years he spent in German East Africa. He prefers to relate his experiences and observations of each kind of animal separately. It is very apparent that he is an accomplished and fearless sportsman, relying at all times solely on his own certainty of aim, presence of mind, and fertility of resource. When he faced the lion or elephant or rhinoceros by day or by night, he had no companion with him armed like himself, and as he was always on foot, he had many a narrow escape. It would be easy to extract from these volumes anecdotes which would astonish and fascinate the reader, but we prefer to refer our readers to the volumes themselves. Big game shooting in South Africa, as practised by Herr Schillings, is an amusement which, in addition to being dangerous, needs an iron constitution, unlimited perseverance and patience, and no small amount of tact, gentleness, and sympathy in dealing with natives. On more than one occasion Herr Schillings' party very nearly fell victims to the warlike and treacherous Masai. But these dangers were, after all, not so formidable as those arising from climatic conditions, and diseases such as dysentery, small-pox, malarial fever, and the like. Not far behind the dangers from disease were those which proceeded from such pests as ticks, sand-flies, scorpions, ants, mosquitoes, and the like.

against which the sportsman, however anxious to do so, was often unable to defend himself. Lastly, but by no means least, there was before him the constant dread of a failure of the water supply, a disaster which could occur in a variety of ways, and might entail a horrible and lingering death on the whole party. In one shape or other, and on many occasions, Herr Schillings had to encounter all these difficulties and dangers, and his accounts of how they were met and overcome are intensely interesting, and, we must add, they do not give the impression of being exaggerated or fanciful.

A naturalist so enthusiastic, skilful, observant, and experienced as Herr Schillings, working in a comparatively little-known tract, was certain to make important contributions to our knowledge of its fauna. On this point we gladly quote the testimony of Professor Paul Matschie, Curator of the Royal Zoological Museum of Berlin :—"There are two distinct species of giraffes, one living to the east of Kilimanjaro, the other in the Pangani region. Schillings has brought home specimens of both species, one of which is now known as *Giraffa schillingsi*, in honour of its discoverer. It has been made clear that the animals killed in the Pangani region can all be distinguished from those secured in the Masai country. Between Kilimanjaro and the coast there are found to be quite different types of baboons, lions, zebras, and buffaloes from those in the Masai country. This fact is of great importance, and Herr Schillings, in enabling us to establish it, has rendered an important service to science. Thanks are also due to him for the careful way in which he has preserved for analysis the contents of the stomachs of animals, as well as the various parasites by which they are infested—ticks, lice, maggots, and the worms in their intestines. He has brought back with him also a great number of very valuable embryos, which further our knowledge as to the development of the Ungulata, their breeding-time, etc. ; the more so that these specimens have been accompanied always by written particulars as to the date at which they were obtained, and other relevant circumstances. He has collected a greater number of different species than any other traveller before him. He has secured three-fourths of the various species which were to be looked for in the districts through which he passed. He has, moreover, discovered several species, the existence of which in or near German East Africa had not been suspected. Great interest was aroused, for instance, by his discovery of a striped hyena, which other travellers imagined they had seen, but had not captured. This is the animal which I have designated *Hyæna schillingsi*. A new species of hill-antelope, or the Klip-springer, has also been discovered by him, which Oscar Newmann has designated *Oreotragus schillingsi*. Among the rodents there are also several new types, while there are several other species among the Ungulates which have still to be classified and named."

From an appendix contributed by Professor Reichenow we gather that Herr Schillings presented to the Royal Zoological Museum in Berlin more than a thousand skins of birds belonging to 355 species, of which five were newly discovered forms.

Unquestionably, however, to the great majority of readers the principal attraction of the book will be the 300 untouched photographs of animals and birds, showing them on land and in the water, in the bush and in the open, asleep and awake, at rest or in movement, *e.g.* springing on their prey, perched on branches or flying in the air, sitting, rising, eating, drinking, singly or in flocks. The photographs were taken by night as well as by day, and naturally give us most accurate views of the velt and jungle of German East Africa. They must be seen and carefully examined to be appreciated ; they hardly admit of description. In the words of Sir Harry Johnston, who contributes an appreciative introduction to

this book, "they form the most beautiful, accurate, and complete picture of the East African wilderness which has yet been given to us by any writer. This book is equivalent, in the case of the stay-at-home reader, to a sojourn of six months amongst the wild animals of the Ethiopian region; while it is bound to produce nostalgia in the minds of returned veterans."

AMERICA.

Canada in the Twentieth Century. By A. G. Bradley. London: Constable, 1905. *Price 5s. net.*

The title of this book is, as the author acknowledges, to a certain extent misleading. With one great part of Canada—with the maritime provinces, with their fisheries, their forests and their orchards—the volume does not deal. Nor does it attempt to make a forecast as to the political future which may await the Dominion during the century which is as yet so young. Further, it must be admitted that it needs some slight previous knowledge of Canadian history to reap the full benefit from the work before us; but this elementary knowledge once granted, the book is not only full of interest, but has also much to teach.

Of all its chapters the most important, perhaps, are those which are devoted to the question of immigration. We are reminded that we British—even those of us who are Scottish—are nowadays too town-bred, too gregarious, too much civilised—if the word is preferred—to be the colonisers and tamers of Nature that we once were, and that Canada has not much room for clerks or lawyers. On the other hand, whether young men are eventually to be farmers or not, there is no such training for muscles, for temper, or for intelligence, as some months with an Ontario farmer. Then, if the land claims the young man as its own, the North-West, or the ranching country near the Rockies, will ultimately be his destination; and if he does not feel that drawing towards farming that makes a man rejoice to clear and plough and sow, let him, before it is too late, turn his industry elsewhither. Even in Canada there is still some room in the towns, provided a man will not despise as menial the work which offers to his hand.

To those who are most keen about Imperial Unity and Union this volume will, we fear, be discouraging. Quebec is French to the core, and the French Canadians in general are a self-centred people, grateful for the freedom and liberty which they enjoy under our flag, and loyal to the King, but more or less indifferent to Imperial interests, content with their own pleasant land, now fast becoming the playground for Canadians and Americans. The political atmosphere of Ontario is more bracing, but scarcely more invigorating, for the Imperial enthusiast. Ontario is the old home of the United Empire Loyalists, it comprises two-fifths of the entire population of Canada, and here, for the present at any rate, must be sought the spring of Colonial public opinion. The men of Ontario are proud of their country, for which they have laboured hard, and which they think of as a nation rather than as a colony, while at the back of their minds lurks the as yet impracticable and scarcely acknowledged desire for "Independence."

The descriptions of scenery are impressive. We have presented to us the Prairie, with its vast patchwork of colouring, with its rolling landscape recalling the Weald of Sussex and of Kent, and then, further West, between Qu'Appelle and Regina, with a broad, apparently illimitable expanse; or again, the foothills of the Rockies, with the mineral wealth—as yet undeveloped—that underlies Alberta and Assiniboia; or the abundant water-power, the ample timber of the North-West; or the swards and lawns of the Pacific slope, and the English oaks and British-like golf-links of Vancouver Island. Equally graphic are the sketches of

the Mounted Police, the envy of their neighbours in the States, of the Canadian commercial traveller or "drummer," and of the strange immigrants from Eastern European Russia, known as the Doukhobors, not so long ago looked upon merely as aliens and lunatics, but now settling down into sober and industrious citizens.

Speaking generally, the book does not fail in its purpose of giving a clear mental picture of "the splendid heritage of our race beyond the sea."

The World of To-day. Vol. V. By A. R. Hope Moncrieff. Pp. 266. Numerous Illustrations, Maps, and Diagrams. London: The Gresham Publishing Company, 1906.

The fifth volume of this admirable series deals with South America, and will awaken the interest of any reader, if there be one, to whom this strange continent has hitherto made no appeal. In his skilful treatment of the subject, in freshness, and in fullness of information, Mr. Hope Moncrieff's latest volume is, if anything, in advance of its predecessors. It includes, by the way, Central America, Mexico, and the West Indian Islands. As previously, the author's short footnotes on special subjects (as on the history of Mexico, or on "Gregor M'Gregor, Cacique of Poyais"), and his illuminative quotations from books of travel, are worthy of special mention. It must be confessed, in spite of the general excellence of the work, that the want of an index is felt. Some person, for instance, may be interested in coal or rubber, but in order to find the information on these matters, which the book contains, the whole of it must be searched. It remains to say that the illustrations throughout, and specially the coloured ones, deserve all praise.

GENERAL.

Lehrbuch der Schwedischen Sprache für den Selbst-unterricht. Von J. E. Poestion. Wien und Leipzig: Hartleben. n.d. *Price 2 marks.*

The range of Hartleben's grammars extends literally from China to Peru, and includes, besides a score of European languages, such diverse tongues as Japanese, Malay, Armenian, Swaheli, Sanskrit, Samaritan, and Namaqua. The above grammar of Swedish (written in German) is by no means the least thorough, devoting, for example, thirty-one pages to the phonetics of the language. The deliberate aim of the author was to include in a small compass all the information possible, and he has certainly succeeded in this, though sometimes at the expense of extreme condensation. The niceties of Swedish idiom seem to have been very clearly apprehended, and are well emphasised.

Martin's Tables; or "One Language in Commerce," containing Tables and Information upon Imperial, Metric, Indian and Colonial Weights and Measures. By Alfred J. Martin. Pp. 271. London: T. Fisher Unwin, 1906.

Although the use of the Metric System is legalised in this country it is not likely to be adopted until it is made compulsory. From a geographical point of view, apart from the convenience of calculating, the greatest advantage would be uniformity with the observations and surveys of foreign countries. At present the inconvenience of different measures of height and length is a very serious one, and even although in the case of maps we are coming to adopt the same standard scales and thereby work conjointly with other countries towards the realisation of certain international schemes, yet as the data are differently stated in feet, fathoms and metres, in miles and kilometres, the results are not readily comparable. To make the change in the British Empire would be a very difficult

matter, as such a change cannot well be introduced gradually. British land and sea surveys are the most extensive in the world. In all our Ordnance Surveys and Admiralty Charts we use English miles, inches, feet, and fathoms, and until the edict goes forth for a change it would be futile to expect the British public to accept surveys with any other measures. The many advantages of the Metric System are ably set forth by Mr. Martin, who is one of its most enthusiastic exponents. His little volume is most complete and exhaustive, dealing with the practical application of the system in all its uses. To geographers, meteorologists, and other scientific workers it ought to prove a valuable reference book.

The Decimal System. By Robert Cockburn Millar, C.A. Pp. 28. Edinburgh: William Blackwood and Sons, 1906. *Price* 2*s.* 6*d.*

Mr. Millar's pamphlet is a paper read before the Scottish Society of Economists, in which, as a professional accountant, he institutes an impartial inquiry into the *pros* and *cons* of the whole question, and finally sums up strongly in its favour. All interested in this important subject will find in Mr. Millar's paper a clear and instructive statement of the whole case.

The Harmsworth Encyclopædia. Vols. I.-VI. London: The Amalgamated Press, and Thomas Nelson and Sons. N.D.

This work is to be commended as a cheap, trustworthy, and complete encyclopædia. The articles are of adequate length and suggestive, and one of the most valuable features of the volumes is the frequent enumeration of the most recent authorities on the subjects treated. The maps are numerous and clear, the illustrations in the text are helpful, but we regret the full-page reproductions of the photographs of individuals and of works of art. It is hardly possible that at the price these should be executed in a manner worthy of the rest of the work, and we regret that there should be any blot on so valuable a compendium of knowledge, and one which will be of assistance to so many students.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

British Canals: Is their Resuscitation Practicable? By Edwin A. Pratt. Cr. 8vo. Pp. xi + 159. London: John Murray, 1906. *Price* 2*s.* 6*d. net.*

A Progressive Course of Comparative Geography on the Concentric System. By P. H. L'Estrange, B.A. Illustrated by 177 Pictures and accompanied by 172 Maps. Size $8\frac{1}{2} \times 12$. Pp. xii + 148. London: George Philip and Son, Ltd., 1906. *Price* 6*s. net.*

The Physiography of the River Nile and its Basin. By Captain H. G. Lyons. Imperial 8vo. Pp. viii + 411. Cairo: Survey Department, 1906.

Origin of the Anglo-Saxon Race: A Study of the Settlement of England and the Tribal Origin of the Old English People. By the late Thomas William Shore. Edited by his sons, T. W. Shore and L. E. Shore. Demy 8vo. Pp. viii + 416. London: Elliot Stock, 1906. *Price* 9*s. net.*

Afghanistan. By Angus Hamilton. Demy 8vo. Pp. xxi + 562. London: William Heinemann, 1906. *Price* 25*s. net.*

The Norwegian North Polar Expedition, 1893-1896. Scientific Results. Edited by Fridtjof Nansen. Volume v. London: Longmans, Green, and Co., 1906.

Handy Guide to Norway. By Thomas B. Willson, M.A. With Maps and Appendices on the History of Norway, Fishing Notes, Glacier Climbing, etc. Fifth Edition. Cr. 8vo. Pp. viii + 275. London: Edward Stanford, 1906. *Price* 5*s.*

Geography of New Zealand for Senior Pupils in the Public Schools, Scholarship Candidates, and Pupil Teachers. By J. R. Macdonald. With twenty-nine Maps and sixteen Illustrations. Cr. 8vo. Pp. 118. Wellington: Gordon-Gotch, Ltd., 1906.

The Harmsworth Encyclopædia. Everybody's Book of Reference. Volume VI. Edinburgh: Thomas Nelson and Sons, 1906.

The Garter Mission to Japan. By Lord Redesdale, G.C.V.O., K.C.B. Extra crown 8vo. Pp. x + 280. London: Macmillan and Co., 1906. *Price* 6*s.*

Summer Rambles. By Thomas M'Kie. Crown 8vo. Pp. xi + 475. Edinburgh: David Douglas, 1906. *Price* 2*s.* 6*d.*

Highways and Byways in Dorset. By Sir Frederick Treves, Bart., G.C.V.O., C.B., LL.D., with Illustrations by Joseph Pennell. Crown 8vo. Pp. xviii + 376. London: Macmillan and Co., 1906. *Price* 6*s.*

Also the following reports, etc.:—

The Aberdeen University Calendar for the Year 1905-1906. Pp. xviii + 252. Aberdeen University Press, 1906.

Gazetteer of the Bombay Presidency. 20 volumes. Bombay, 1904.

District Gazetteer of the United Provinces of Agra and Oudh. By H. R. Nevill, I.C.S. Vols. XLII., XLIII., and XLIV. Allahabad, 1905.

Some Facts about the Weather. By William Marriott, F.R.Met.Soc. Pp. 32. Edward Stanford, 1906. *Price Sixpence.*

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st May 1906:—Four Miles to One-inch, printed in colours and folded in cover, or flat in sheets. Sheet 6. Price, on paper 1s. each; mounted on linen 1s. 6d. each.

One-inch Map third edition, engraved, in outline. Sheets 27, 39. Price 1s. 6d. each.

Six-inch and larger Scale Maps.—Six-inch Maps (Revised), full sheets, heliozincographed, with contours. *Inverness-shire.*—Sheet 5. Price 2s. 6d. each.

1 : 2500 Scale Maps Revised) with Houses ruled, and with Areas. Price 3s. each. *Ross and Cromarty.*—Sheets XIA. 13, 14, 15; XVIII. 8, 12, 13, 14, 15, 16; XVIIIA. 9, 13; XXV. 4; XXVI. 3, 4; XXVII. (1 and 2), 5, 6, 8, 10, 11, 12, 16; XXVIII. 5, 9, 10, 13, 14 (15 and 11); XL. 4; XLI. 1, 2, 3, 4, 5, 7, 8, 11, 12, 15, 16; XLII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; LV. (15 and 12). *Sutherland.*—Sheets CII. 14, 15, 16; CVII. 4, (8 and 12); CVIII. 5, 9, 10, 13, 14, 15; CIX. 15; CXI. 6, 7, 11; CXIII. 1. Sheet CVII. 3. Price 1s. 6d.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY: SCOTLAND.—The following publications were issued from 1st to 31st May 1906:—Six-inch Maps, quarter sheets, uncoloured. Price 1s. 6d. each. *Edinburghshire.*—1 SE.; (1B SE. and 1 SW.); 8 SW.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

A RIDE FROM QUETTA TO LORALAI.

By Lieutenant-Colonel A. C. YATE.

BALUCHISTAN is a wide word. I am not prepared at the present moment to express it in terms of European states, which is a popular and effective way of setting forth the vast area (often area *et præterea nihil*, for the population is scant) of some of these Oriental provinces of ours. It extends east and west from the Punjab to the Persian frontier, and north and south from Afghanistan to the sea. It is ruled by a Chief Commissioner. It was made by Sir Robert Sandeman, the first Chief Commissioner.

Baluchistan must be written about by sections. It is too large to be treated of as a whole in a brief paper. I am tempted to write of the Quetta-Loralai road section, for I think that of all it is the most beautiful and picturesque. My wife and I had occasion in June 1896 to visit Quetta, and after a pleasant stay there, a ride along the extended belt of fortifications, and a delightful run in a trolley through the Khojak tunnel to Chaman, we made up our minds to conclude our trip with a ride from Quetta *viâ* Kach and Ziarat to Loralai.

Whenever strangers hear the name Loralai, it carries their thoughts away to the Lurlei of the Rhine, and they instinctively remark, "What a pretty name!" I have always felt a curious interest in the origin of this name. It was quite unknown till the Indian Government founded the cantonment now so called. A most reliable authority assures me that the founder of Baluchistan was asked to provide a name for the new cantonment, and suggested "Loralai." A name is nothing if not appropriate. "Loralai" is appropriate. "Lora" means "a river-bed," "lai" means "tamarisk." Dry stony torrent-beds overgrown with tamarisk are a marked feature in the Loralai landscape. But let us leave Loralai for the present (it should be the Omega and not the Alpha of this short sketch), and revert to our ride there from Quetta.

We had two horses and half a dozen mules for the carriage of ourselves, servants, and baggage. As luck would have it (possibly the *syces*, *i.e.* grooms, knew more about it than luck did) my wife's Arab was found seriously lame thirty-six hours before we had to start. However, a transport mule-tonga kindly lent us and a pony picked up at the last moment pulled us out of that pinch. A tonga is a low two-wheeled cart with seats for two in front (one the driver) and two behind. The seats are arranged to hold baggage. It is drawn by two ponies or mules. The feature of tonga harness is the iron bar which passes over the ponies' withers and links them. This harness is strong and serviceable,

The house of the Officer Commanding the troops of the Khan of Kalāt, Baluchistan. Taken at Kalāt in 1904

and admits of rapid changes of animals. The tonga is used on all the government postal roads in India, *e.g.* between Kalka and Simla, Gauhati and Shillong (Assam), etc. We started to time, sent the two horses, pony, and mules ahead on the afternoon of the 28th June, and starting ourselves in the tonga at daybreak on the 29th, overtook the advanced party twenty miles out at nine o'clock. Our road ran west, first for seven or eight miles across the stony Quetta plain, then up and up for another six or seven, following the course of ravines and spurs amid the lower slopes of Takatu, one of the highest peaks (over 11,000 feet) near Quetta, and skirting the rear of the right or south-west flank of the Quetta defences. At Sarakulla the summit of the pass is approached. Gandak, where we overtook our horses and servants, and breakfasted, was a good four miles (all down hill) west of the head of the pass. A

little low bungalow with a corrugated iron roof and tiny rooms, and the air shut out by the encircling hills—such was Gandak. It is ungrateful to carp at a shelter that was, after all, only too welcome in the heat of the last days of June; but we were very glad when 3 P.M. arrived and we judged we might mount (the tonga was sent back from Jandak) and ride on to Kach, nine or ten miles further. The direct rays of the sun tempered by a breeze were less trying than the still heat in closed rooms under an iron roof. This was the only day during our march that we really felt the heat. The average elevation of the road from Quetta to Loralai is probably over 6000 feet; and that elevation secures in summer almost invariably cool nights and bearably hot days. Of course we avoided riding, as a rule, between 10 A.M. and 3 P.M. The fourteen miles of country from Sarakullah to Kach bore on it Nature's brand of barrenness. High up were the bare rocks, while lower down on the slopes and in the ravines were massed in fantastic conglomeration what looks like Earth's dross, cast out by her own volcanic action as being too sterile or too poisonous to retain—a dross of many colours, red, brown, white, grey, slate, etc. All reflected forcibly the sun's rays.

At Kach (a station on the Sind-Pishin railway) we found ourselves at a place which I had scarcely seen and never stopped at since August 1880. On that occasion, the night after my regiment passed through it, 2000 Pathans attacked and rushed the little fort held by about 200 native infantry, and were with difficulty repulsed.

From Kach to Ziarat the road winds through a wild mountainous country, the distance being between thirty and thirty-five miles. To the left or north the village of Amadun appears, picturesquely perched on the slopes of a side valley. On the right or south is the great dark mass of the Pil mountain, sparsely studded with junipers, whose twisted gnarled trunks and boughs fill one with wonder at the freaks and vagaries of Nature's handiwork. I know no such trees elsewhere except in Doré's illustrations of Dante's *Inferno*. These junipers (or "pencil cedars," as some call them) look the very victims of some sylvan demon. Their grim, weird forms, no two alike, disport themselves in tens of thousands on the mountains around Ziarat. The Pil rift and lake are other queer freaks of nature. The rift cuts through the great Pil mountain from the village of Kawas across to the well-known Chappar rift on the Sind-Pishin railway. The Pil lake is probably the result of a landslip or some seismic disturbance, which has dammed the natural channel of the Pil river. The Cyclopean magnitude of Nature's works in these rifts of Baluchistan is what fills eye and mind with wonder. Every traveller who visits Quetta has seen how Sir James Browne and his staff of Royal Engineers carried the railway through the Chappar rift. I was with a brigade that marched through it in August 1880. It is only two miles long or so, but it took us all day to get our camels and baggage through it.

Ziarat is the hill-station of, and is some 2300 feet higher than, Quetta. Its great charm is that, in a country where natural vegetation is scant, it is abundantly wooded. Its real name is Gwashki, but it has been rechristened by some one Ziarat, and Ziarat it will remain. I

wish I could depict the charm of its mountain scenery, the ravines luxuriant in all European vegetation, the wild cherry-trees, and currant and gooseberry bushes, the grand view of the appalling cliffs of Khalipat, (a mountain over 11,000 feet high), the queer "potholes" in the ravines where the explorer is brought to a sudden standstill with a sort of dry devil's caldron below him and perpendicular cliffs on either side above. The most striking of these "potholes" (waterfalls in raintime) is in "Lady Sandeman's Tangi" (gully or rift). The Pathans told us that only one man was ever known to have climbed from bottom to top of it. To us such a feat seemed a sheer impossibility; but one or two of the Pathans with their bare, prehensile feet, showed us how part of the

Pathan Levy Sowar.

ascent could be made. Just before we reached Ziarat, the biggest flood known for years had swept the valley clean; gardens and polo-ground, and the dam and ditch that were to protect them from flood, all went in an hour or two. As we marched up the valley to Chotair we saw ample traces of the flood in crops laid level with the ground and half-buried in mud deposit.

I look upon the ride from Ziarat to Chotair as a pleasant experience not easily to be equalled even in countries famed for fine scenery. In Baluchistan it is unique. Wood and water, and mountain and glen, and all beauties of vegetation combine to form a panoramic picture sixteen miles in length. It is as pure and real a pleasure to ride along this road, as it is to—let us say, traverse the Killiecrankie or Brenner passes. Six miles out of Ziarat near the top of the "Kotal" (kotal = "head of the pass") is a perfect stretch of wood and sward, an ideal site for a

cantonment. Polo, cricket, football, all on turf, suggest themselves. But—always a but—there is little or no water. This is the true "Ziarat," which means "Mohammedan shrine or place of worship and pilgrimage." The saintly ascetic who chose this spot to live and die in evidently held that Nature's own beautiful temples are made to worship in. He was no "Stylites." Crossing the head of the Kotal the road winds down a steep, wooded ravine, with a beautiful clear burn below (more often heard than seen) running and leaping along amid the rocks and boulders that centuries have laid bare or shed from above. There is game around, both large and small. The "markhor" (a mountain goat), on the stiffest peaks, the "uriyal" on more accessible heights, the "mum" bear, and for small game "chikor" and "sisi," two species of hill partridge. Of the human inhabitants of the country I will say little more than that they are mostly Pathans, and the Pathans to be appreciated must be actually seen. Kawas, however, is held and cultivated by a Persian settlement, who retain to this day their ancestral ways and habits. The Kawas valley is a model of cultivation, the village clustering on and around a hillock in the midst, in a way that recalls to mind villages I have seen in Persia or, even more so, the European towns or townlets of the feudal period.

Chotair, when you get there, is charming, with a stream of the most delicious water bubbling out close to the traveller's bungalow. Behind, just over the hill, is Shirin, the head village of the Wanechi Pathans, and thence runs a longish hill-path *viâ* Pui to Loralai. We had to abide by the regular road. Strolling about under the junipers at Chotair, I met the Wanechi chief coming in from Shirin. He had a Martini or Snider carbine in his hand. We had a little talk together, and finally he asked if I could put him in the way of getting some ammunition for his carbine, as he had none. I could not oblige him myself. I thought if Government considered him a suitable person to own such a carbine, it should also give him some ammunition for it.

Shirin, Pui, and Sinjawi (our next stage) produce in much perfection the one good fruit (besides the melon) that this country possesses, viz. the grape. From Chotair to Sinjawi is a long stretch—twenty-four miles. We broke the back of it by going out six miles in the evening, camping by some water, and doing the remaining eighteen miles the next morning. With Chotair we leave all the beautiful vegetation. The road descends to a level of some 5500 feet above the sea-level, and for twelve or thirteen miles between Wani and Rejora not a drop of water is seen: in short, the beauty of the ride is almost at an end. I say almost, because the fresh greenness of the Smalan and Sinjawi cultivation relieves the eye, and the myrtle groves there are, as far as I know, unequalled. These groves are charming at all seasons, but in June and July, when the blossom is at its best, they surpass themselves. The trees grow 25 feet high, and intertwine into dense groves, covering each an acre or more. I have seen nothing like it elsewhere. Sinjawi is an important centre. Through it passes the high road from Harnai (a station on the Sind-Pishin line) to Loralai, and roads come in from Ziarat and Thal-Chotiali, as well as one or two

hill-paths from the south. Its importance as a centre led to the construction of a fort there at a considerable outlay. At present a few policemen hold that fort.

The twenty miles of road from Sinjawi to Loralai, beyond a certain wild picturesqueness, possess little interest. At least I, who have ridden

Defile on the road between Hurnai and Loralai.

it a dozen times, think so. I only count the milestones and wish for the end. Loralai is one of those frontier stations grown up in the last twenty years. A cavalry and infantry regiment, and a mountain battery (all native) was the garrison allotted to it. At first it knew no ladies, but ere long they crept in. They always creep in; and who would wish to keep them out? They established themselves at the Malakand Pass in 1895, almost before Chitral was relieved. We welcomed them to Mandalay some time before Burma could be called "pacified." When

we recall what our women suffered and did during the evil days at Kabul in 1841-2, and during the siege of Lucknow in 1857, we can do no less than welcome them whenever and wherever they come to share our frontier life. When I first saw Loralai, the fireplaces that warmed the tents of the garrison (all were in tents for a year or so till barracks were built) were still standing. That first year a Bengal cavalry regiment lost some fifteen per cent. of its strength by pneumonia. It chanced that some disrespect had been shown to the local Ziarat or Mohammedan shrine by this corps, and native opinion firmly held that this epidemic was the saint's revenge. The sanctity of these and similar places is, in our eyes perhaps, a superstition, but in those of Mohammedans a hallowed and binding truth, and no one can disregard this with impunity. By this hang some curious and sad tales difficult to explain.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.[1]

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART XI.—THE LOCHS OF THE BEAULY BASIN.

THE Beauly basin is an important and extensive one, extending across almost the entire width of Scotland, from Beauly firth on the east coast to within about 4 miles from the shores of Loch Duich, and about 6 miles from the shores of Loch Carron, on the west coast. The basin is situated in a very mountainous district, many of the peaks in the central and western part of the basin exceeding 3000 feet, and some of them approaching 4000 feet, in height, while on proceeding eastward towards the outlet of the basin the land becomes gradually less elevated. On the southern boundary of the basin are Tigh Mor (3222 feet), Sgùrr nan Conbhairean (3634 feet), Garbh Leac (3673 feet), Sgùrr nan Ceathramhan (3614 feet), Ciste Dhubh (3218 feet), Carn Fuaraloch (3241 feet), and Sgùrr a' Bhealaich Dheirg (3378 feet); on the western boundary Beinn Fhada (Ben Attow), 3383 feet, Sgùrr nan Ceathreamhnan (3771 feet), Lurg Mhor (3234 feet), and Sgùrr Choinnich (3260 feet); on the northern boundary Sgùrr a' Chaoruinn (3452 feet), Bidean an Eoin Deirg (3430 feet), Maoile Lunndaidh (3294 feet), Sgùrr Fhuar-Thuill (3439 feet), Sgorr a' Choir-Ghlais (3552 feet), and Sgùrr Ruadh (3254 feet); while in the central part of the basin are Craig Dhubh (3102 feet), Sgùrr na Lapaich (3773 feet), An Riabhachan (3696 feet), Beinn Fhionnlaidh (3294 feet), Mam Sodhail (Mam Soul, 3862 feet), Carn Eige (3877 feet), Tom a' Choinich (3646 feet), a second peak named Sgùrr na Lapaich (3401 feet), and Tuill Creagach (3452 feet).

[1] Abbreviated from article, with maps, in *Geographical Journal* for June 1906.

Besides these heights there are many others which do not attain the 3000-feet level. In the valleys between these chains of mountains lie the lochs which were sounded by the Lake Survey staff. In the most northerly valley, Glen Strath Farrar, there is the connected series consisting of Lochs Calavie, an Tachdaidh, an Gead, Monar, a' Mhuilinn, and Bunacharan; in the central valley, Glen Cannich, the connected series of Lochs Lungard, Mullardoch, and Sealbhag; and in the most southerly valley, Glen Affric, the connected series of Lochs Affric, an Laghair, and Beinn a' Mheadhoin; with the isolated Loch na Beinne Bàine as an outlier situated towards the head of Strath Glass. These valleys all trend in a more or less east-and-west direction, converging towards the north-east, where the river Beauly is formed by the junction of the river Farrar with the river Glass. The river Glass is formed by the junction of the Amhuinn Deabhaidh (bearing the outflow from Loch na Beinne Bàine) with the river Affric, while the river Cannich is a tributary of the river Glass. The area of the Beauly basin, as measured with the planimeter on the 1-inch Ordnance Survey maps, is about 343 square miles, of which about 215 square miles (or 63 per cent.) drain into these thirteen lochs. All the lochs exceed half a mile in length, while eight of them exceed a mile in length; the two largest lochs (Mullardoch and Monar) exceed four miles in length, and have each an area exceeding a square mile. Seven of the lochs exceed 100 feet in depth, and two of them exceed 200 feet, the deepest one being Loch Monar with a maximum depth of 260 feet; this loch is also the one containing the largest volume of water. The boundary-line between the counties of Inverness and Ross runs up the centre of Loch Monar for the greater part of its length, and it crosses Loch Mullardoch in its central portion, so that these two lochs lie partly in Ross-shire and partly in Inverness-shire; four of the others (Lochs Lungard, Calavie, an Tachdaidh, and an Gead) are situated in Ross-shire, and the remaining seven in Inverness-shire. The scenery of the district around the lochs is very fine, and the trout-fishing in most of the lochs very good; some of them contain pike also.

Loch Affric.—Loch Affric (or Affaric) lies about 26 miles to the south-west of Beauly, which is the nearest railway-station, and about 11 miles from Glen Affric Hotel at Cannich, the nearest house of entertainment. The loch trends in a west-south-west and east-north-easterly direction, and is nearly $3\frac{1}{4}$ miles in length. It is broadest towards the western end, where the maximum breadth is nearly half a mile, narrowing gradually, though irregularly, on proceeding towards the eastern end, the mean breadth of the entire loch being a quarter of a mile. The superficial area is about 526 acres, or over four-fifths of a square mile, and the area drained by the loch is nearly 47 square miles. The maximum depth of 221 feet was observed near the centre of the loch. The volume of water is estimated at 2146 millions of cubic feet, and the mean depth at nearly 94 feet. The loch was surveyed on October 6 and 7, 1903, when the elevation of the lake-surface above the sea was determined by levelling from bench-mark as being 747·0 feet; when levelled

by the officers of the Ordnance Survey on July 3, 1867, the elevation was found to be 744·1 feet above sea-level, or 3 feet lower than 1903.

Loch Affric is quite simple in conformation, the deeper water occupying a central position, from which the bottom slopes upward to the shores on all sides. The 50-feet contour coincides approximately with the outline of the loch, enclosing a basin nearly 2½ miles in length, approaching comparatively close to the west end, but distant more than a quarter of a mile from the east end. Separated from this main 50-feet basin by shallower water is an isolated sounding of 54 feet near the east end, where the main loch is joined by the little subsidiary basin called Loch Pollan Fearna, in which a maximum depth of 30 feet was observed. The 100-feet basin is 2½ miles in length, and the 150-feet basin nearly 1½ miles in length, approaching in each case nearer to the west end than to the east end. The 200-feet basin is about three-quarters of a mile in length, and is approximately equidistant from both ends of the loch, but the deepest sounding in 221 feet was taken towards the west end of the basin, and therefore nearer to the western end of the loch. A section across the loch in the position of the deepest sounding shows a very slight irregularity in the deepest part of the loch, where a sounding in 209 feet was taken between a sounding in 211 feet on the one hand, and the greatest depth of the loch (221 feet) on the other. Another line of soundings, about three-quarters of a mile further east, shows a shoaling in deep water, where a depth of 122 feet was recorded between a depth of 130 feet on one side, and 159 feet on the other. With these exceptions, the various lines of soundings show a regular bottom, with a steep off-shore slope in some places along both the northern and southern shores. Thus, proceeding along the northern shore from the east end of the loch, the first line of soundings gave a depth of 40 feet at a distance of 20 feet from shore; the fourth line of soundings gave a similar depth at a similar distance; the fifth line gave a depth of 28 feet at 10 feet from shore; the ninth line gave 47 feet at 30 feet; the next line gave 21 feet at a distance of 20 feet; the next line 84 feet at 60 feet distance; the next 35 feet at 25 feet distance; and the next line 36 feet at 30 feet distance. In like manner proceeding along the southern shore from the east end, the sixth line of soundings gave a depth of 76 feet at a distance of 50 feet from shore; the next line gave 31 feet at 20 feet distance; the next line 47 feet at 15 feet distance; the next line 33 feet at 20 feet distance; and the next line 34 feet at 30 feet distance. All these figures indicate a slope exceeding 1 in 1, and in one case a slope exceeding 3 in 1.

A series of temperatures taken at 3 P.M. on October 6, 1903, in the deepest part of the loch, shows that the extreme range is only 4·4° from surface to bottom, the fall of temperature being very gradual.

Loch an Laghair.—Loch an Laghair lies a little over a mile to the north-east of Loch Affric, and is practically continuous with Loch Beinn a' Mheadhoin, for normally the two lochs stand at the same level, although an easterly gale sets up a strong current through the narrows at Blàr an Àth, in which a depth of 5 feet was observed. The loch trends

in a north-east and south-west direction, and is nearly two-thirds of a mile in length. The maximum width exceeds a quarter of a mile towards the western end, whence the loch narrows gradually towards the eastern end. The superficial area of the loch is about 83 acres, and the area draining directly into it nearly 6 square miles, but since it receives the overflow from Loch Affric its total drainage area is about $52\frac{1}{2}$ square miles, an area over four hundred times greater than that of the loch. The deepest sounding in 100 feet was taken in the central part of the loch, but rather nearer to the north-east end. The volume of water is estimated at 135 million cubic feet, and the mean depth at $37\frac{1}{4}$ feet. The loch was surveyed on October 6, 1903; but the elevation of the lake-surface above the sea could not be determined by levelling, as there was no bench-mark near the loch. The level was estimated at about 703 feet above sea-level.

Loch an Laghair forms a simple basin, the shallower contours coinciding approximately with the outline of the loch, but approaching closer to the northern shore in the eastern half of the loch, where the off-shore slope is steepest. The western end is apparently being silted up. The 75-feet area is extremely small, for on each side of the deepest sounding in 100 feet, at a distance represented by twenty strokes of the oar, the depths were 66 and 64 feet respectively. The area of the lake-floor in Loch an Laghair covered by less than 50 feet of water is about 63 acres, or 76 per cent. of the total area of the loch. The temperature of the surface water at 3.30 P.M. on the date of the survey was 48·0° Fahr., the air-temperature being 42·0°.

Loch Beinn a' Mheadhoin.—Loch Beinn a' Mheadhoin (or Beinnavian or Beneveian) trends generally in a north-east and south-westerly direction, and is over $2\frac{1}{2}$ miles in length. The loch is fairly uniform in width, the two end portions being somewhat narrower than the central portion, which has a maximum breadth of nearly half a mile, the mean breadth of the entire loch exceeding a quarter of a mile. The superficial area of the loch is about 504 acres, or over three-quarters of a square mile, and the area of land draining directly into it is about $15\frac{1}{2}$ square miles; but since it receives the superfluent waters from Lochs Affric and an Laghair, the total drainage area is about 68 square miles. The maximum depth of 167 feet was observed in a central position, but nearer to the eastern than to the western end of the loch. The volume of water is estimated at 1435 millions of cubic feet, and the mean depth at over 65 feet. The loch was surveyed on October 6, 1903; but the elevation of the lake-surface above the sea could not be determined by levelling. The water in the loch was very high on the date of the survey, the level then being estimated at about 703 feet above sea-level, but the normal level is probably about 700 feet.

Loch Beinn a' Mheadhoin is rather complex in conformation, including as it does three deep basins separated by shallower water. Near the western end of the loch is a small basin having a maximum depth of 95 feet, and near the eastern end is a larger basin having a maximum depth of 117 feet, while the largest and deepest basin occupies the central por-

tion. The two ridges separating these three basins may be due to the deposition of material brought down by the streams entering the loch at these places along the northern shore, of which the westerly stream (Amhainn a' Ghlinne Fhiadhaich) is the more important; the maximum depth observed on the western ridge was 69 feet, and on the eastern ridge 97 feet. The 25-feet and 50-feet contours are continuous from end to end of the loch, while the 75-feet contour is broken at the position of the western ridge, and the 100-feet contour is broken at the position of the eastern ridge. The eastern 100-feet basin is nearly half a mile in length, and the main 100-feet basin nearly $1\frac{1}{2}$ miles in length; within the last-mentioned basin is a long narrow 150-feet basin, based on soundings of 159, 167, and 154 feet, with an isolated sounding in 156 feet a quarter of a mile farther west. It seems doubtful whether this isolated sounding may not be connected with the principal basin by deep water, and in that case the 150-feet basin would be nearly a mile in length. The deepest sounding in 167 feet was recorded about a mile from the eastern end of the loch, and about $1\frac{1}{2}$ miles from the western end. A cross-section, in this position, shows a steeper gradient off the northern than off the southern shore; but the soundings, as a whole, afford no evidence of any very steep slopes. The deeper part of the loch has quite a flat-bottomed character.

The largest zone is the one between 75 and 100 feet, and the area of the lake-floor covered by less than 50 feet of water is about 178 acres, as compared with 270 acres covered by water between 50 and 100 feet in depth, or 35 per cent. as compared with 53 per cent. In most lakes the arrangement is the reverse of this, the areas between consecutive contour-lines drawn at equal intervals, usually decreasing with increase of depth. The temperature of the surface water at the east end on commencing the survey was 50·0° Fahr., the temperature of the air being 42·5°, while later in the afternoon, towards the opposite end, the surface temperature was 49·5°; but an easterly gale having sprung up, it was found impossible to take serial temperatures beneath the surface.

Loch na Beinne Bàine.—Loch na Beinne Bàine lies in Guisachan forest, about four miles to the south-east of Loch Beinn a' Mheadhoin, and eight or nine miles to the west of Invermoriston on Loch Ness. It is irregular in outline, trends in a north-north-east and south-south-westerly direction, and is nearly a mile in length, with a maximum breadth of nearly half a mile. The superficial area is about 154 acres, or a quarter of a square mile, and the area draining into it about $1\frac{1}{2}$ square miles. The maximum depth of 67 feet was observed about a quarter of a mile from the southern end of the loch, midway between an island of stones and the eastern shore. The volume of water is estimated at 190 million cubic feet, and the mean depth at $28\frac{1}{3}$ feet. The loch was surveyed on June 6, 1904, but the elevation of the lake-surface above the sea could not be determined; the height of the water at the sluice was about 2 feet, and at one time the loch appears to have been considerably higher.

Loch na Beinne Bàine forms a simple basin; the 25-feet contour

coincides approximately with the outline of the loch, but is deflected at the position of the island of stones off the western shore towards the southern end, while the 50-feet basin, based on soundings of 67, 64, 54, and 52 feet, is contained in the southern half of the loch, and is about a quarter of a mile in length. The soundings indicate in one or two places slight undulations of the lake-floor, but as a rule the slope of the bottom is regular and gentle. The area covered by less than 25 feet of water is about 95 acres, or 62 per cent. of the total area.

A series of temperatures taken in the deepest part of the loch indicates an extreme range of temperature from surface to bottom amounting to 14·3°, there being a fall of 9·5° between 10 and 20 feet (*i.e.* from 60·0° to 50·5°) that is nearly a fall in temperature of one degree per foot of depth. Reference has elsewhere been made to the large range and rapid fall of temperature observed in Lochs Monzievaird, Achilty, and Dubh,[1] and the temperatures observed in Loch na Beinne Bàine afford another instance for comparison.

Loch Lungard.—Loch Lungard (or Longart, or Glasletter) lies at the head of Glen Cannich, about 5 miles to the north of Loch Affric. It trends east and west, and is 1½ miles in length, with a maximum breadth towards the west end of one-third of a mile, whence the loch narrows gradually towards the east. The superficial area is about 216 acres, or one-third of a square mile, and the area draining into it is nearly 23 square miles. The maximum depth of 129 feet was observed in a central position, but towards the east end. The volume of water is estimated at 599 million cubic feet, and the mean depth at nearly 64 feet. The loch was surveyed on October 7, 1903, when the elevation of the lake-surface above the sea was found by levelling from bench-mark to be 761·3 feet, which is nearly identical with the level observed by the Ordnance Survey officers on October 14, 1867, viz. 761·2 feet. When surveyed the water was about its normal level, and in floods might rise about 3 feet.

Loch Lungard is extremely simple in conformation, the bottom sloping down on all sides towards the deepest part, not the slightest irregularity being indicated by the soundings, while the contour-lines coincide approximately with the outline of the loch. The 50-feet basin is 1¼ miles, and the 100-feet basin rather under a mile, in length, and they are comparatively wide, so that the loch is of a flat-bottomed character.

A series of temperatures, taken at 2 P.M. on the date of the survey in the deepest part of the loch, indicates a range of only 1·2° Fahr. throughout the body of water.

Loch Mullardoch.—Loch Mullardoch (or Mulardich, or Moyley) lies less than 2 miles to the east of Loch Lungard, and is practically continuous with Loch Sealbhag, there being a small expansion of the river between them called Loch Ath a' Bhàn, which was not sounded. Loch

[1] *Scottish Geographical Magazine*, xxi. (1905), p. 473.

Mullardoch trends generally in an east and westerly direction, and is somewhat irregular in outline, with a slight bend in the central portion. It exceeds 4 miles in length, and is pretty uniform in width, the maximum breadth being less than half a mile, and the mean breadth over a quarter of a mile. Its waters cover an area of about 756 acres, or considerably more than a square mile, and the area draining directly into it is about 27½ square miles; but since it receives the outflow from Loch Lungard its total drainage area exceeds 50 square miles. The maximum depth of 197 feet was observed in the eastern portion of the loch, about a mile and a half from the east end. The volume of water is estimated at 2553 millions of cubic feet, and the mean depth at 77½ feet. The loch was surveyed on October 7, 1903, but the elevation above the sea was not determined; when levelled by the Ordnance Survey officers on November 29, 1866, the elevation of the lake-surface was found to be 704·9 feet above sea-level. On the date of the survey the water was about a foot above the normal level, and two days previously it had been 3 feet higher.

Loch Mullardoch is divided into two deep basins by a shoaling of the water in its central portion, where there is a constriction and bend in the outline, the maximum depth in the western basin being 150 feet, and in the eastern basin 197 feet, the depth on the shoaling being 80 feet. A section along the centre of the loch from end to end brings out the central shoaling referred to, which is apparently traceable to the influence of the streams entering on both sides of the loch at this place, and principally of the Allt Taige, at the mouth of which, on the northern shore, is a considerable delta. The 50-feet contour is continuous, and encloses a basin nearly 4 miles in length. The western 100-feet basin exceeds half a mile in length, separated by an interval of over half a mile from the eastern 100-feet basin, which is one and a half miles in length, and includes a 150-feet basin over a mile in length. All the cross-lines of soundings show a regular bottom, the water deepening gradually from the shore towards the centre, with a steep off-shore slope in some places, as, for instance, along the southern shore off Creag Dubh, where a sounding in 24 feet was taken about 20 feet from shore, and off Creag a' Bhaca, at the deepest part of the loch, where a sounding in 94 feet was taken about 100 feet from shore.

A series of temperatures, taken at 4.30 P.M. on the date of the survey in the western basin, shows that the water was nearly uniform in temperature, the extreme range from surface to bottom being only 1° Fahr., the readings down to a depth of 50 feet being identical.

Loch Sealbhag.—Loch Sealbhag lies to the east of, and is, as already stated, practically a continuation of Loch Mullardoch. It trends in a north-east and south-westerly direction, and is two-thirds of a mile in length, with a maximum breadth towards the west end of nearly a quarter of a mile, whence it narrows gradually towards the north-east. Its waters cover an area of about 68 acres, and it drains directly an area of 3½ square miles, but since it receives the outflow from Lochs Lungard and Mullardoch, its total drainage area is nearly 54 square

miles—an area nearly five hundred times greater than that of the loch. The maximum depth of 56 feet was observed in the widest part of the loch towards the western end, and comparatively near the southern shore. The volume of water is estimated at 61 million cubic feet, and the mean depth at over 20½ feet. The loch was surveyed on October 5, 1903, but the elevation above the sea could not be determined.

The wide western portion of Loch Sealbhag includes a deep basin exceeding 30 feet in depth, which approaches comparatively close to the western end, and is over a quarter of a mile in length. To the north-east of this basin the bottom rises, and falls again on approaching the outfall to a depth of 31 feet, the depth on the rise being 16 feet. The area of the lake-floor covered by less than 20 feet of water is about 39 acres, or 57 per cent. of the total area. The temperature of the surface water on the date of the survey was 50·5° Fahr.

Loch Calavie.—Loch Calavie (or Calvie) lies about 6 miles to the north-west of Loch Lungard, and only 7 miles from the head of Loch Carron on the west coast of Scotland, at a high elevation among the mountains, the lower slopes of which are covered with peat. The loch trends in a north-west and south-easterly direction, and is considerably over a mile in length, with a maximum width towards the western end exceeding one-third of a mile, whence the breadth gradually decreases on approaching the eastern end. The superficial area is about 167 acres, or a quarter of a square mile, and the area draining into it nearly 2½ square miles. The maximum depth of 84 feet was observed in a central position, but rather nearer the western than the eastern end. The volume of water is estimated at 276 million cubic feet, and the mean depth at 38 feet. The loch was surveyed on October 19, 1904, when the elevation was found by levelling from bench-mark to be 1128·35 feet above the sea—a little lower than the elevation as determined by the Ordnance Survey officers on August 14, 1866, viz. 1128·5 feet above sea-level.

Loch Calavie is perfectly simple in conformation, the contour-lines coinciding approximately with the shoreline, though in each case they approach nearer to the western than to the eastern end of the loch, so that the average slope is steeper towards the head of the loch. The 25-feet basin is nearly a mile, and the 50-feet basin three-quarters of a mile, in length. The soundings give no indication of any steep off-shore slopes, and the average slope between the 25-feet and 50-feet contours is less steep than in shallower water.

A series of temperatures taken in the deepest part of the loch shows that on the date of the survey the whole body of water was practically uniform in temperature, the extreme range being less than 1° Fahr.

Loch an Tachdaidh.—Loch an Tachdaidh lies about 2 miles to the east of Loch Calavie, and is almost continuous with Loch an Gead, the stream between them being a very short one, and the difference in level only 1½ feet. The term Gedd Lochs is applied to the connected series, consisting of Loch an Gead, Loch an Tachdaidh, and the neighbouring little Loch an Gobhlach, which was not sounded. Loch an Tachdaidh is irregular in outline, trends in a north-east and south-westerly direc-

tion, and is nearly two-thirds of a mile in length, with a maximum breadth exceeding one-third of a mile. Its waters cover an area of about 92 acres, and it drains directly an area exceeding 4 square miles, but since it receives the overflow from Loch Calavie, its total drainage area is over 6½ square miles. The maximum depth of 62 feet was observed in the centre of the north-eastern portion of the loch, near a heap of stones, showing above the surface of the water. The volume of water is estimated at 72 million cubic feet, and the mean depth at 18 feet. The loch was surveyed on October 21, 1904; the elevation could not be determined by levelling, but was estimated at about 831·5 feet above the sea.

Loch an Tachdaidh is irregular in conformation as well as in outline, and, besides the island of stones already mentioned, includes four small unnamed islands, the largest of which occupies a central position; the south-western portion is shallow and filled with weeds. The contour-lines are sinuous in character, the deepest part lying between the largest island and the heap of stones, where three soundings exceeding 50 feet in depth were taken. To the south of the largest island, and towards the eastern shore, a sounding in 25 feet was recorded, surrounded by shallower water. The area of the lake-floor covered by less than 25 feet of water is about 74 acres, or 81 per cent. of the total area. A series of temperatures taken in the position of the deepest sounding shows a range of only 1·2 Fahr. throughout the body of water, the deeper layers being uniform in temperature.

An Gead Loch.—An Gead loch lies to the north-east of Loch an Tachdaidh, and trends in a similar direction, but is more regular in outline and more uniform in width. An Gead loch is nearly 1¼ miles in length, with a maximum width towards the south-west end of a quarter of a mile. The superficial area is about 110 acres, and the area draining directly into it is about 2½ square miles, but since it receives the outflow from Lochs Calavie and an Tachdaidh, the total drainage area exceeds 9 square miles. The maximum depth of 30 feet was observed towards the north-eastern end of the loch. The volume of water is estimated at 54 million cubic feet, and the mean depth at 11¼ feet. The loch was surveyed on October 21, 1904, and the elevation was estimated at about 830 feet above sea-level. The bottom of an Gead loch is irregular and stony, so much so that in the deeper part no mud could be got, while the shallow western portion is covered with sand. Though irregular, the basin has a flat-bottomed character, for the majority of the soundings were taken in depths exceeding 10 feet, and only three soundings in depths exceeding 20 feet. The area of the lake-floor covered by more than 10 feet of water is about 62 acres, or 56 per cent. of the total area. The temperature of the water was nearly uniform on the date of the survey, a reading at the surface giving 46·7° Fahr., and a reading at 25 feet 46·0°.

Loch Monar.—Loch Monar lies at the head of Glen Strath Farrar,

little more than a mile to the north-east of an Gead loch, and is one of the most important lochs in the Beauly basin. In length and in superficial area it is slightly inferior to Loch Mullardoch, but it is the deepest of the series, and contains the largest volume of water. The general trend of Loch Monar is east and west, but with a slight sinuosity in the outline, the length exceeding 4 miles. The width varies considerably, the maximum breadth of nearly half a mile occurring near the west end, the mean breadth of the entire loch exceeding a quarter of a mile. The waters of the loch cover an area of about 750 acres, or over one square mile, and the area draining directly into it is about 41 square miles, but since it receives the overflow from Lochs Calavie, an Tachdaidh, and an Gead, the total drainage area is about 50 square miles. The maximum depth of 260 feet was observed much nearer the eastern than the western end. The volume of water is estimated at 3213 millions of cubic feet, and the mean depth at 98⅓ feet. The loch was surveyed on October 10, 1903, when the elevation of the lake-surface above the sea was found to be 663·9 feet; when levelled by the officers of the Ordnance Survey on June 20, 1866, the elevation was 662·8 feet above sea-level. At the time of the survey the water was about its normal level, and might rise to the extent of several feet.

Loch Monar is quite simple in conformation, all the contour-lines enclosing continuous areas, and the cross-lines of soundings indicating a regularly sloping bottom from the shores out towards the centre of the loch. A longitudinal section along the centre of the loch from end to end shows slight undulations of the lake-floor, the shallowings coinciding with constrictions in the outline. The contour-lines all approach nearer to the eastern than to the western end of the loch, showing a steeper slope in an easterly direction from the deepest sounding, which was taken less than a mile from the east end, or one-fourth of the distance from one end to the other. The off-shore slope is in places very steep, especially along the southern shore at the deepest part of the loch, where near the centre of the loch a sounding in 104 feet was taken about 120 feet from shore; a little farther east another sounding in 50 feet was taken about 50 feet from shore; still farther east a sounding in 148 feet was taken about 120 feet from shore, and still farther east a sounding in 87 feet about 60 feet from shore. The last-mentioned sounding, which gives a slope of 29 in 20, was taken on the cross-line immediately to the east of the deepest sounding and the steepest gradient observed off the northern shore was at the opposite end of the same line, where a sounding in 54 feet was taken at about 60 feet from shore. A cross-section taken at the position of the deepest sounding shows a gentle off-shore slope, succeeded by a steeper slope on proceeding into deep water, the deeper part of the loch being of a flat-bottomed character. The area enclosed by the 50-feet contour is 3½ miles in length, being distant from the west end nearly three-quarters of a mile, and extending into the narrow part at the east end off Creag Ghràda; in the expansion of the outflowing river, opposite Creag Dhubh, a depth of 64 feet was observed. The 100-feet basin is 3 miles, the 150-feet basin 2½ miles, and the 200-feet basin over one mile, in length.

A series of temperatures, taken in the deepest part of the loch at 4 P.M. on the date of the survey, shows that the whole body of water varied little in temperature, being in fact uniform in temperature down to 100 feet, the extreme range amounting to only 1·2° Fahr.

Loch a' Mhuilinn.—Loch a' Mhuilinn (or Moilie) is a small irregular loch lying about 5 miles to the east of Loch Monar. A terrace of gravel surrounds the loch, except on the northern shore, where the hill An Carnach rises steeply from the lake-shore. There is a large island named Eilean a' Mhuilinn near the east end, and two smaller islands at the mouth of the inflowing river at the west end. The loch trends in an east-north-east and west-south-westerly direction, and is nearly a mile in length, with a maximum breadth in the centre exceeding one-third of a mile, whence it narrows towards the two ends. The superficial area is about 100 acres, and the area of land draining directly into it is about $37\frac{3}{4}$ square miles, but since it receives the overflow from Lochs Monar, an Gead, an Tachdaidh, and Calavie, its total drainage area is nearly 88 square miles—an area 550 times greater than that of the loch. The maximum depth of 94 feet was observed in the wide part of the loch towards the northern shore. The volume of water is estimated at 150 million cubic feet, and the mean depth at over 34 feet. The loch was surveyed on October 12, 1903, when the elevation was determined by levelling from bench-mark as being 417·65 feet above the sea; when visited by the Ordnance Survey officers on June 1, 1866, the elevation was found to be 417·5 feet above sea-level. A drift-mark was observed 5 feet above the surface of the water on the date of the survey, when the level was about its normal.

Loch a' Mhuilinn consists of a deep central basin, with two small subsidiary shallow basins at the two ends, as is clearly shown by a longitudinal section. Towards the west end, immediately to the north of the island at the mouth of the inflowing river, a depth of 25 feet was recorded, separated from the main basin by a rise of the bottom, on which a maximum depth of 12 feet was observed. Towards the east end, between Eilean a' Mhuilinn and the mouth of the outflowing river, a depth of 24 feet was recorded, separated from the main basin by a depth of 3 feet in the narrows between the island and the northern shore. In the main deep basin the contour-lines are continuous and the bottom regular, seven soundings in depths exceeding 80 feet having been recorded to the west and south-west of Eilean a' Mhuilinn, two of them in depths exceeding 90 feet. The area of the lake-floor covered by less than 50 feet of water is about 72 acres. A series of temperatures taken in the deepest part of the loch shows that the body of water was nearly uniform in temperature on the date of the survey, the extreme range observed being less than 1° Fahr.

Loch Bunacharan.—Loch Bunacharan (or Banchron) lies less than a mile to the east of Loch a' Mhuilinn and about 6 miles east of Loch Monar, and is the last member of the series of lochs in Glen Strath Farrar. The shores are mostly of gravelly débris, forming terraces about 20 feet

high, which are best seen along the south shore; the surrounding hills are high and rugged, and well wooded. The loch trends east-north-east and west-south-west, and is $1\frac{1}{4}$ miles in length, with a maximum width of nearly one-third of a mile, the superficial area being about 157 acres, or a quarter of a square mile. The area draining directly into Loch Bunacharan is only about 4 square miles, but it receives the overflow from Lochs Calavie, an Tachdaidh, an Gead, Monar, and a' Mhuilinn, and its total drainage area is therefore a very large one—about 92 square miles. The maximum depth of 113 feet was observed towards the east end of the loch—less than half a mile from the east end and more than three-quarters of a mile from the west end. The volume of water is estimated at about 343 million cubic feet, and the mean depth at over 50 feet. The loch was surveyed on October 12, 1903, when the elevation of the lake-surface above the sea was found by levelling from bench-mark to be 366·15 feet; when levelled by the officers of the Ordnance Survey on June 9, 1866, the elevation was 366·5 feet above sea-level. On the date of the survey the water was about its normal level, and a recent drift-mark was observed 9 feet above the surface of the water, while an older drift-mark was 11 feet above the water-surface.

Loch Bunacharan is irregular in conformation, the lake-floor in the deeper part of the loch rising and falling in a series of undulations. The 25-feet and 50-feet contours are continuous from end to end of the loch, and coincide approximately with the shore-line. The 75-feet contour, however, encloses three distinct basins separated from each other by shallower water, viz. (1) a very small basin based on a sounding in 83 feet about 300 yards from the western end; (2) a larger basin a quarter of a mile in length, and trending almost north and south, *i.e.* transversely across the loch, based on soundings in 78, 82, and 88 feet, situated about one-third of a mile from the western end; and (3) the largest and deepest basin, one-third of a mile in length, approaching to within a quarter of a mile from the eastern end, and enclosing a small basin exceeding 100 feet in depth, based on soundings in 105, 111, and 113 feet. Between the second and third basins above noted there is a rise of the lake-floor near the middle of the loch, covered by 43 feet of water, surrounded on all sides by deeper water. The slope of the bottom seems to be gentle on the whole, the steepest gradient observed being off the northern shore towards the west end, where a sounding in 48 feet was taken about 50 feet from shore. The area of the lake-floor covered by less than 50 feet of water is about 80 acres, or 51 per cent. of the total area. A series of temperatures, taken in the deepest part of the loch, show that the whole body of water was practically uniform in temperature.

In the thirteen lochs under consideration, which cover an area of $5\frac{3}{4}$ square miles, about 850 soundings were taken, or an average of 146 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 11,230 millions of cubic feet, and the area draining into them is over 215 square miles, or thirty-seven times the area of the lochs.

GEOLOGICAL NOTES ON THE LOCHS WITHIN THE BASIN OF THE FARRAR.

By B. N. Peach, LL.D., F.R.S., and J. Horne, L.L.D., F.R.S.

The mapping of the western part of the Beauly basin by the Geological Survey has only been carried southwards to the watershed between Glen Strath Farrar and Glen Cannich, and hence the following notes are confined to the lakes lying within the basin of the Farrar. This area is entirely occupied by the metamorphic rocks of the Highlands, which have been arranged in two divisions: (1) an older series, which has been correlated with the Lewisian or Archæan gneiss of the West Highlands; and (2) a group of crystalline schists, termed the Moine series by the Geological Survey, which are regarded as altered sediments, and are supposed to rest unconformably on the older Lewisian gneiss.

The members of the older series comprise hornblendic and biotite gneisses, and ultrabasic masses, together with crystalline limestone, graphite schists and eclogites, which resemble the rocks of Lewisian age in the neighbourhood of Glenelg. The Moine series includes two prominent subdivisions: 1. flaggy and massive quartz-biotite-granulites; and 2. muscovite-biotite schists, the latter probably representing an argillaceous phase of sedimentation. In the basin of the Farrar the general strike of the crystalline schists, with the exception of local variations, is north-north-east and south-south-west or north-east and south-west—that is to say, obliquely across the course of the main valley.

The basin of the Farrar is traversed by a powerful dislocation, which passes from the Conon valley in a south-west direction by Gleann Chorainn and the head of the river Orrin, thence across Loch Monar to the south-west shoulder of the Riabhachan. It forms a well-marked feature, and is accompanied by much brecciation and staining of the rocks, as may be seen along its course to the north-east of Loch Monar. At certain localities, parallel or branching faults, presumably connected with the main dislocation, are met with, which modify to some extent the surface features.

During the period of confluent glaciers, the ice radiating from the mass of high ground south of Loch Monar, embracing Sgurr na Lapaich, 3773 feet, and An Riabhachan, 3696 feet, and from the heights between that lake and Gleann Fhiodhaig to the north, flowed eastwards down Glen Strath Farrar, and streamed northwards through some of the passes towards the Orrin and Glen Fhiodhaig, and westwards in the direction of the valley of the Ling. At a later stage it escaped only by Strath Farrar. The diverging movement through the various passes is indicated partly by ice-markings, and partly by the disposition of the moraines.

Loch Monar is a true rock basin carved mainly out of the crystalline schists of the Moine series, modified by the movements accompanying the Strath Conon fault and its branches, to which reference has already been made. The lip of the basin is now about half a mile below the present outlet of the lake, the intervening area being silted up by the alluvium brought down by Allt Coire na Faochaige—a tributary which joins the main stream opposite Monar Lodge. The rocks forming the barrier of the lake are well seen in the gorge of the Garbh-uisge, where they consist of massive siliceous Moine schists, intensely plicated along vertical axes trending north-east and south-west.

In the narrow part of the lake immediately above Monar Lodge there is a small subsidiary basin, which may be accounted for by inequalities in the hardness

of the rocks, and by the irregular distribution of the drift on the west side of the loch. The deep part of the main basin coincides with the belt of crushed strata accompanying the Strath Conon fault that crosses the lake near Lub-an-Inbhir and the parallel dislocation above Creag na h-Iolaire. A third fault, trending east and west, enters the loch at the mouth of Alt nan Uan, which has produced considerable brecciation of the rocks.

The shallow bar near the head of the loch is due to a spit of sand, brought down partly by Allt Riabhachan and partly by the stream at Pait, which has been distributed by the action of the waves. The long stretch of alluvium along Amhainn-an t-Stratha Mhòir indicates that the lake has been silted up for about a mile above its present western limit.

Loch an Tachdaidh and An Gead Loch.—These lochs lie in the bottom of the valley drained by the Garbh-uisge at Pait, which flows into Loch Monar, and are entirely surrounded by drift deposits of the later glaciation. All the small projections into these lakes are due to moraine heaps, arranged in such a way as to suggest that they are probably the terminal moraines of a lobe of ice that moved westwards towards the basin of the river Ling.

Loch Calavie lies in one of the passes through which the ice escaped westwards from the Monar area during the period of confluent glaciers. Though immediately surrounded by moraines and peat, it is evidently in part a rock basin, as the rocky barrier formed of muscovite-biotite gneiss appears in the stream not far below the outlet of the lake. The deepest sounding is 84 feet.

Loch Bunacharan and Loch a' Mhuilinn.—These lakes are situated in the valley of the Farrar about midway between Loch Monar and Struy. Their long axes seem to coincide generally with the strike of the crystalline schists. In the case of the former lake, its height above sea-level is 366 feet, its greatest depth 113 feet, and the position of the rocky barrier exposed in the stream about one-third of a mile below the outlet is about 360 feet. The surface level of Loch a' Mhuilinn is 417 feet, and the deepest sounding is 94 feet, and as it discharges over solid rock, it is evidently a small rock basin. There is a high terrace round Loch a' Mhuilinn and on the south side of Loch Bunacharan at a level of 440 feet.

NOTES ON THE BIOLOGY OF THE LOCHS OF THE BEAULY BASIN.

By James Murray.

The lochs of Beauly valley were surveyed in late autumn, during very severe weather, unfavourable for the study of biology. The lochs in Glen Affric were visited in a time of heavy floods, which raised the lochs several feet while we were working at them. Though the tow-nets were used, there was almost nothing got in them. The lochs appeared to be flushed and washed out by the spate, or else the animals had gone down to quieter water.

Throughout the rest of the basin there was great uniformity, the ordinary universal limnetic Crustacea and Rotifers alone being present, with little call for remark. There was an entire absence of all the northern species of *Diaptomus*, and, although Desmids were fairly abundant in most of the lochs, there was none of the western species.

The few species which only occurred in some of the lochs are noted below. These are also generally distributed in summer, their scarcity in these lochs being due to the late season at which they were visited.

Daphnia.—In all the lochs where *Daphnia* occurred, it was as the variety *galeata*, a large form with the head angled.

Holopedium gibberum.—Only in Lochs Calavie and an Tachdaidh.

Leptodora kindtii.—Only in Loch Monar.

Polyphemus pediculus.—An Gead loch.

Cyclops strenuus.—Present in most of the lochs. The *Cyclops* in Loch Calavie were red-spotted.

Diaphanosoma brachyurum.—Found in four lochs—Tachdaidh, Bunacharan, Mullardoch, and Lungard.

Floscularia pelagica.—Loch Monar.

Conochilus.—Both species, *C. unicornis* (the common lake species) and *C. volvox*, were present in Loch Monar.

Sponge.—A fresh-water sponge, species not determined, came up attached to the sounding-rod, from depths of 6 or 8 feet, in Loch a' Mhuilinn. The pieces were long and finger-shaped.

ANTARCTIC BOTANY: ITS PRESENT STATE AND FUTURE PROBLEMS.

By R. N. Rudmose Brown, B.Sc., Scottish National Antarctic Expedition.

The botanical collections of recent antarctic expeditions having now been in the main determined and the results published either in forecast or in full, it is possible to take a survey of our existing knowledge of the botany of antarctic regions and to draw attention to some localities which especially require exploration, and to some of the more pressing problems that await study.

It is very generally supposed that the antarctic regions are almost destitute of botanical interest, and are the last place on the earth's surface where plants can be looked for, and in truth, until quite recent years, our botanical knowledge of these regions was so scanty that there was at least some ground for such a belief, for almost the only collections known were those of Joseph Hooker in Ross's expedition of the *Erebus* and *Terror* in 1839-1843.

The recent renewed interest in the antarctic as expressed in the expeditions of the last decade have by their various collections and observations shown that the south polar flora, poor as it may be, is nevertheless in some respects richer than was supposed, and gives the botanist good reason to hope for further results from future expeditions. The chief interest in these collections lies, of course, in the questions they give rise to in the problems of geographical distribution and the light they throw on the study of the former configuration of land and water in south polar regions. For at a time when geological and oceanographical evidence forces the scientist to abandon the old conception of the permanence of ocean basins, it is not impossible that a careful examination of the distribution of present-day floras, especially in the light of recent advances in palæobotany, may be productive of some evidence

towards a reconstruction of former land connections in the southern hemisphere.

The adaptations of the various species to their environment, a study particularly valuable in the case of cosmopolitan species, promises most valuable results, but is not likely to be seriously undertaken until the systematic and geographical interests of the collections have been worked out in full. For a newer study almost invariably has to wait until the older aspects of the science have been satisfied. It is, moreover, extremely desirable that such physiological and morphological questions should be studied on the spot; indeed, the impracticability of satisfactory investigation in any other circumstances is most obvious. The difficulty of laboratory accommodation in the isolated antarctic regions is naturally great, but not nearly so great as is generally supposed. Various expeditions which have recently wintered in the south have shown that the climatic conditions, though not exactly as favourable as in the north, offer no serious inconvenience to an ordinary robust constitution and cheerful disposition, even though one is not prepared to rough it in the manner of the geographical explorer. And, furthermore, it should be remembered that there are at the present time at least three habitable dwellings within the regions of south polar ice:— one, Omond House, at the South Orkney Islands, built by the Scottish National Antarctic Expedition in 1903, another at Wandel Island on the west of Graham Land, where the French Antarctic Expedition spent the winter of 1904, and a third at Snow Hill on the east of Louis Philippe Land, the station of the Swedish South Polar Expedition in 1902 and 1903. Of these the house at Scotia Bay, South Orkneys, is permanently inhabited as an Argentine Meteorological Observatory, while that at Wandel Island will be taken possession of next year for a similar purpose. Nordenskjöld's house at Snow Hill in the meantime stands vacant for whoever cares to make use of it. Thus it will be seen that laboratory accommodation on a small scale in the antarctic regions is far from impracticable, and should not be a matter of any very great cost. These stations, it may be remarked, are not very far to the south; but that is a distinct advantage, for while all are within the veritable polar regions and experience the real antarctic climate, they escape in very large measure the long night and its attendant drawbacks and, most important consideration of all, they are readily accessible, so that a relieving ship should experience little difficulty in gaining all or any of them every summer. The Danes have now established in north polar regions on Disco Island a fully equipped biological laboratory, and the extreme desirability of a similar station in south polar regions need not be further urged. But in the meantime, until this larger project can be put into execution, it would be most desirable that a biologist should be attached to each of these antarctic observatories during the coming year, though, of course, as the number of inhabitants at each observatory must be very strictly limited, he would combine his biological studies with the duties of a meteorological observer.

The most striking feature of the antarctic flora is, of course, its poverty compared with that of the arctic. Thus the arctic regions support about

four hundred species of flowering plants, while the antarctic regions support but two, and even these can hardly be said to flourish. The reasons which bring about this extreme contrast between north and south is one of the most interesting biological problems that await solution in these regions.

The amount of light available is of course the same in north and south at corresponding latitudes, and yet the contrast between the two vegetations is even more marked when one remembers that at Spitsbergen in 79° N., the ground is bright in summer with a hundred species of flowering plants, while at the South Orkneys in only 61° S. there is not a single species. Snow is probably not much more abundant in the south, and winter temperatures at least in the outermost south polar regions, neglecting for the moment comparative latitudes, are not more severe than in the north.

The real explanation is probably to be found in the short and inadequate antarctic summer with its remarkably low temperatures. Thus, for example, at the South Orkneys in 60° 44′ S. the mean of the summer months (December, January, and February) is only 31·7° F., or including March, 31·9° F., and in no month does the mean rise to 33° F., while the mean of the warmest day in 1903-4 was only 37·7° F.; at Snow Hill Island, Louis Philippe Land (64° 24′ S.), the mean of the warmest month (January) was found to be only 30·38° F., while at Cape Adare, Victoria Land, in 71° 18′ S., the summer mean is 30·4° F.

These temperatures may be compared with those of the arctic regions. Thus at Spitsbergen (79° 53′ N.) the mean temperature of July (the corresponding month to January in the south) is as high as 41·5° F., while in Franz Josef Land, in over 80° N., it is not lower than 35·6° F. in the same month. The mean of the Spitsbergen summer (June, July, and August) is 37·1° contrasted with the corresponding mean given above for the South Orkneys, 31·7°. Examples could thus be multiplied, but all would bring out the same important point, that while the arctic summer mean is well above 32° F., the antarctic summer mean is practically always below. This remarkably cold antarctic summer acts in two ways upon plant life: *firstly*, the winter snow lies late on the ground—all the later as the summer is a cloudy and somewhat sunless period, and December is well advanced before the majority of available sites are laid bare, while in February the winter[1] again begins; *secondly*, and this is the chief reason, it is doubtful if a flowering plant could obtain the requisite amount of heat needed for its various life functions even to reach the flowering stage, while the maturation of its fruit would be next to impossible. In fact, one could with much truth say that the antarctic summer is but an astronomical conception: those who have experienced it know well how little reality it has. Doubtlessly, then, in this want of a season of growth lies a quite adequate explanation of the poverty of the south polar vegetation, but I think that there is also another adverse influence at work. Even supposing that a species did obtain a footing

[1] Contrast this with the north, where, for example, at the northern part of the east coast of Greenland, the land is clear from snow from May or early June until September, dates which would correspond in the south to November to March.

on Antarctica, as is not impossible in the lands nearest Fuegia, considering the narrowness of Drake Strait, its continued existence would be at once menaced by the presence of the myriads of penguins which occupy almost every bare spot of ground during the nesting and breeding season. There is no parallel in the north to these penguins and the power they would have in destroying any vegetable life. Almost every spot where a plant might obtain a hold is covered with these birds in the proportion of at least one to a square yard, and nothing escapes their insatiable curiosity or fails to be examined with their beaks, while in a few weeks' time such a rookery is in an indescribable state of filth, being entirely covered with several inches of mud and manure through which the penguins are incessantly tramping hither and thither; circumstances which would render plant life quite out of the question. It is true that here and there one finds a small expanse—even as much as an acre I have once seen—of moss-covered rocks which by successive years' growth are covered with six to eight inches of vegetable soil, but these are spots much less accessible from the sea, and are very seldom suitable for rookeries—which is, of course, the sole condition under which this continuous growth of moss from year to year could continue. In such spots one might look, though in vain, for flowering plants, and perhaps in consequence conclude that the influence of the penguins, though potentially inimical to vegetable life, has never cause to operate. But it must be noted that these moss formations, though in many respects suitable for phanerogamic plant life, are yet always very late in losing their winter snow, and generally lie in sheltered places where wind-carried seeds would be little likely to arrive. That seeds of Fuegian species of phanerogams occasionally reach Graham Land and adjacent South Shetland and South Orkney Islands is more than probable considering the prevalence of winds from the north of west in that region : it is even possible, though far less likely, that wind-carried seeds from Kerguelen and Heard Island occasionally alight on parts of the coast of Wilkes Land. The likelihood of the transport of seeds by birds is lessened by the fact of there being only one true land bird (*Chionis alba*) in the antarctic, but it is not impossible that some seeds are occasionally carried adhering to the feet of such wandering birds as the southern black-backed gull, the skua, and the giant petrel, which range from sub-antarctic to antarctic lands. As regards floating ice, I do not think that in the antarctic it ever acts as an agency in the dispersal of species.

It is, therefore, not by reason of their isolation alone that the south polar regions have next to no phanerogamic vegetation, but because they are unsuited in one way or another to support it. If such a modest biological station, as I have advocated above, should be instituted, it would be of extreme interest to attempt to cultivate on certain of the mossy oases various species of hardy arctic plants, such as *Papaver nudicaule*, *Ranunculus sulphureus*, *Cerastium alpinum*, *Saxifraga oppositifolia*, etc. etc., which all prosper and produce seed at Spitsbergen.[1]

[1] I myself have attempted to make such an experiment by sending to the Argentine Station at the South Orkneys a supply of seeds of 22 arctic species of phanerogams, with a

Dr. Skottsberg, of the Swedish Antarctic Expedition, considers that the formidable antarctic winds must be another unfavourable condition for higher plant life.[1] While fully admitting the strength of the winds that sweep over certain localities the greater part of the year, I do not yet think they could have an inimical influence on any possible vegetation, partly because there are always certain sheltered spots, but largely because the antarctic summer is a relatively calm period, while the winds of winter could of course have no prejudicial influence through the covering of snow.

Before turning to a consideration of the actual vegetable life of the antarctic, especially as revealed by the expeditions of the last few years, it would be advisable to define the limits of the antarctic regions from a phytogeographic standpoint. On this subject there has been much diversity of opinion, largely attributable to an almost complete ignorance of the conditions obtaining in the south.

Dr. Skottsberg in a recent paper[2] has ably discussed the whole question, and he clearly points out the obvious error that phytogeographers commit in placing the boundary of the antarctic regions too far to the north so as to include, according to some, even part of South America: as untenable a position as that of those who would restrict the antarctic to the regions south of the astronomical antarctic circle. Dr. Skottsberg shows that the parallel of 60° S. forms a more or less natural limit, and in this proposition of his I quite agree.

The flora of the antarctic regions as thus defined contains only two phanerogams, namely *Descampsia antarctica* (Hook.) Desv., and *Colobanthus crassifolius*, Hook. f. var. *brevifolius*, Eng. The former of these has long been known from antarctic regions, having been collected by Eights about 1820 at the South Shetlands, and it also occurs on Danco Land, but its discovery, along with *Colobanthus crassifolius*, by Dr. Turquet, of the French Antarctic Expedition, at Biscoe Bay, Anvers Island, in 64° 50′ S. 68° 40′ W., is very interesting, for this is the most southerly record for flowering plants known. *Descampsia antarctica* was also found by Dr. Turquet at Wandel Island, 65° 5′ S. It is extremely probable that further exploration will somewhat extend the range of

request to have them planted in a certain spot which I chose as suitable during my stay at Scotia Bay in 1903. But whether this experiment has had any result, or even been attempted, I cannot yet say, and the fact of there being no biologist at present attached to the party in residence there will mitigate against the chances of the experiment being carefully watched. The seeds sent were all of arctic species, and it may be as well to publish the complete list, which is as follows:—*Papaver nudicaule*, L., *Draba alpina*, L.; *D. hirta*, L., f. *rupestris*, R. Br.; *Cochlearia officinalis*, L., var. *β*, Vahl; *Vesicaria cretica*, Poir.; *Silene acaulis*, L.; *Cerastium alpinum*, L.; *Potentilla nivea*, L.; *Alchemilla alpina*, L.; *Saxifraga oppositifolia*, L.; *S. nivalis*, L.; *S. rivularis*, L.; *S. hypnoides*, L.; *Sedum Rhodiola*, D.C.; *Erigeron alpinum*, L., var. *grandiflorum*, Rahl.; *Hieracium alpinum*, L.; *Vaccinium uliginosum*, L.; *Arctostaphylos uva-ursi*, Spreng.; *Armeria pubescens*, L.; *Oxyria reniformis*, Hook.; *O. elatior*, R. Br.; *Luzula spicata*, Desv.

[1] *On the Zonal Distribution of South Atlantic and Antarctic Vegetation.* Carl Skottsberg. *Geog. Jour.*, Dec. 1904.

[2] *Some Remarks on the Geographical Distribution of Vegetation in the colder Southern Hemisphere*, Carl Skottsberg, *Ymer* (Stockholm), 1904, p. 402. This paper also contains a useful bibliography of antarctic and sub-antarctic botany.

these species. Reference has been made by me elsewhere[1] to the reputed grass of the South Orkneys, of whose occurrence we have no evidence except the vague report of a sailor, and which I know from personal search does not grow to-day in the place indicated. Ferns are entirely wanting in the antarctic, as was only to be supposed, but mosses are relatively abundant and form almost the chief constituent of the flora. Collections[2] of these are known from various points around the pole, including Graham Land, South Shetlands (*Belgica*, *Antarctic*, *Français*), South Orkneys (*Scotia* and Argentine Expedition), Emperor William II. Land (*Gauss*), and Victoria Land (*Southern Cross* and *Discovery*), but those from the Atlantic and American sides are incontestably the richer, no doubt largely because of the nearer proximity of extra-polar land and consequent possibility of migration, but also to some extent because that side of the antarctic regions has received more careful and serious exploration than any other. Dr. Jules Cardot, who has examined the mosses brought back by all the recent expeditions, places the total number of species at present known at 50. The *Belgica* collected 27 species on the west of Graham Land, and the *Southern Cross* 3 on Victoria Land. Among recent expeditions the *Antarctic* collected 23 species on Louis Philippe Land, among which are several identical with those the *Scotia* brought from the South Orkneys. The mosses collected by the *Français* number 13, all from Wandel Island, Hovgaard Island, and Wiencke Island in Gerlache Strait off Danco Land, and with the exception of four are all different to my South Orkney species. The *Discovery's* collections include, Dr. Cardot informs me, seven species of mosses from MacMurdo Strait and Mount Terror, only two of which are known from Graham Land, and one from the South Orkneys. From the South Orkneys 14 species are known, of which 10 are from the *Scotia* collection, and the remaining four from the collections of Señor L. H. Valette of the Argentine Observatory (1904).

A fuller discussion of the problems involved by these collections may soon be expected from the pen of Dr. Cardot, and in consequence it is better to refrain from discussing here certain questions of distribution; suffice to say that almost fifty per cent. are endemic in the antarctic, and about twenty-five per cent. are cosmopolitan in their distribution.

The life conditions for mosses are evidently not very unfavourable, for most of the species show a fairly vigorous growth and do not appear to suffer from the severe environment. This can especially be remarked in those species which have a wide distribution throughout other parts of the world, for in them it is possible to make a comparison of the effects of the antarctic climate and soil on the growth of the plant. In the South Orkneys I noticed that for at least seven months, and in

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1 *The Botany of the South Orkneys.* R. N. Rudmose Brown. *Trans. and Proc. Bot. Soc. Edin.*, XXIII. i. (1904-5).

2 *Résultats du Voyage du S.Y. Belgica, Mousses,* J. Cardot, *Anvers* (1901). *Report on the Southern Cross Collections,* London (1902). *Note prél. sur les mousses rec. par l'exped. ant. suédois.* J. Cardot, *Bull. Herb. Bois.*, vi. p. 13, and other papers quoted.

places eight, the moss was frozen as hard as rock, but this did not seem at all to impair its vitality on the return of spring: further south, and mosses have been collected in the far south of Victoria Land (78° S.), their frozen condition must last longer. This same occurrence has, of course, been previously well known in north polar regions. Vegetative reproduction among antarctic mosses seems to be the rule, and fruiting specimens of most species are very rare among the collections of all the expeditions: among my South Orkney specimens the only species with many and well-developed fruits was *Polytrichum subpilifirum*, Card., and Dr. Cardot says that among all the species of antarctic mosses he has seen only four in fruit: among the thirteen species of the French Expedition all were sterile.

The number of antarctic hepatics[1] is naturally not great, and includes not more than six species, of which three are found in Gerlache Strait, one at the South Shetlands, and three in Orleans Channel. In the South Orkneys no species was discovered. While several fungi are recorded from sub-antarctic islands, such as Tristan da Cunha, Gough Island, and others, the true antarctic regions support but a single species, the discovery of which was made by M. Racovitza of the *Belgica*: this is a new species, *Sclerotium antarcticum*, Bomm. et Rous,[2] and was found on Danco Land growing among *Aira antarctica*: apparently this is its only record.

Undoubtedly the predominant feature of the antarctic vegetation is the number of lichens, not as species, but as individuals. At the South Orkneys the lichen vegetation is very rich. In winter, when almost everything is deep in snow, a few precipitous rock faces still show a relieving touch of colour among the monotonous white, due largely to various orange-coloured species of *Placodium* (*P. fruticulosum*, Darbish. and *P. elegans*, Nyl.): when the snow begins to melt in spring almost all the rocks bared to view show a shaggy covering of *Usnea melaxantha*, Ach., a species which more than any other seems to luxuriate in the conditions of life to be found there, and produces good "fruits" in quantity: Dr. Skottsberg also mentions the frequency of *Placodium* and *Usnea* in the lands he visited. Two other species, *Rhizocarpon geographicum*, D.C., and *Lecidea fusco-atra*, Th. Fr., are less abundant, and owing to their more sombre colour and less striking appearance do not lend any very characteristic feature to the landscape. The number of species of antarctic lichens is relatively high, but the determinations of several recent collections are not yet published, and in their absence it is impossible to draw any deductions of a general nature. With regard to my South Orkney lichens, Dr. O. V. Darbishire remarks[3] that all the species, except, of course, the new one, were previously recorded from some part of the arctic regions, and that, taking into account all known collections, the proportion of arctic species is as high as 73 to 75 per cent.

[1] *Rés. du Voy. du S.Y. Belgica, Hépatiques*, F. Stephani, *Anvers*, 1901, and *Wiss. erg. der Schwed. Südpolar Exp. Hepaticae*, F. Stephani, *Stockholm*, 1905.

[2] *Rés. du Voy. du S.Y. Belgica, Champignons*, Bommer et Rousseau, *Anvers*, 1903.

[3] *The Botany of the South Orkneys, Lichens*, O. V. Darbishire *loc. cit.*

The lichens of Gerlache Strait as collected by the *Belgica*, numbered fifty-five, including another new species of *Placodium* (*P. regale*, Wain.), which would therefore seem to be a genus particularly adaptable to antarctic conditions. Of these fifty-five species 38·2 per cent. are known from arctic regions, and as many as 52·7 per cent. are new.[1]

The algological flora of the antarctic is far from poor in individuals, if perhaps the species are not very numerous. At the South Orkneys, for instance, I collected twenty-five species[2] (including five new), and this number would doubtless be increased by careful exploration in summer when the coast is free from ice. Calcareous algae are exceedingly common, especially two species (*Lithophyllum discoideum*, f. *aequabilis*, Fosl., and *L. decipiens*, Fosl.). M. Foslie has identified new forms among the collections of all recent antarctic expeditions.[3] In places these algae cover the rocks in a few feet of water with a fairly continuous incrustation that at first deceives one into the belief that it is an ice formation. The daily haul of the dredge which we took in Scotia Bay hardly ever failed to bring up specimens of calcareous algae. Among other algae the commonest species in Scotia Bay were the two red algae *Plocamium coccineum*, Lyngb., and *Acanthococcus spinuliger*, Hook. and Harv., extraordinarily abundant in ten fathoms, and the brown alga *Desmarestia Rossii*, Hook. and Harv., frequent in much shallower water: this latter species was also collected by the *Southern Cross* off Victoria Land. The southern kelp *Macrocystis pyrifera* has been proved to be absent from all ice-girt islands, and its existence is doubtlessly incompatible with the eternal wearing and tearing influence of the ice. Its place is to some little extent taken by *Lessonia grandifolia*, Gepp, a species with some similarities in habit to that of the "kelp," though which is anything but abundant, and has apparently only been found at Louis Philippe Land and the South Orkneys.

Only one species of fresh-water alga (other than unicellular algae) is so far known, namely the cosmopolitan *Prasiola crispa*, Ag., which is recorded from both Graham Land and the South Orkneys. In the latter place it was to be found in summer and autumn in several small gulleys where a quantity of melting snow above assured a continual supply of moisture. Unicellular algae naturally form the vast preponderance of the botanical treasures of the antarctic regions. When once the regions of ice are approached between 50° S. and 60° S. the plankton entirely changes its character; crustaceous and, in fact, all animals then become rare, and give place to increasing numbers of diatoms until, in the midst of the ice, the diatoms occur in such prodigious quantities that five minutes' haul of the tow-net (No. 20 miller's gauze) produces as much as a pint of gelatinous residue almost wholly diatomaceous. The fact that such a net used about thrice daily on the average ceases to be serviceable after about a week or ten days' use, owing to the clogging of the apertures in the silk, will give an idea

[1] *Rés. du Voy. du S. Y. Belgica, Lichens*. Ed. A. Wainio. Anvers, 1903.

[2] *Antarctic Algae*, A. and E. S. Gepp, *Journ. Bot.*, April 1905 and May 1905, and *More Antarctic Algae*, *loc. cit.*, July 1905.

[3] See Foslie in *Kgl. Norske Vidensk. Sels* (1904), p. 3.

to any one used to plankton work of the wealth of diatomaceous life in these seas. The species are not very varied, but a large proportion of them bear spines and long arms, while simple forms are comparatively rare. Peridineans occur, but only rarely. The phytoplankton on the whole seems to favour deep water, for in the shallow water about the South Orkneys it was much scarcer. In winter the greater part is apparently frozen into the ice, for I failed to get any appreciable quantities from the water on the occasions when I bored the floe with this object in view. The first-formed pancake ice is always yellow, and the lower layers of the floe as revealed in the spring upheaval are uniformly discoloured by a layer of diatomaceous ice.

In no part of the antarctic seas visited by the *Scotia* did I observe the open water discoloured by diatoms, and I am not aware that other recent expeditions have recorded this occurrence, but Mr. W. S. Bruce in the cruise of the *Balaena* in 1892-93 between 62° and 63° S. off Louis Philippe Land, frequently remarked that the sea was olive green or olive brown from this cause, and that the most usual species in these discoloured parts was *Corethron criophilum*. This phenomenon is of much commoner occurrence in arctic seas.[1] Plankton collections well within antarctic seas and over a wide area are largely confined to the collections of the *Scotia*, which fortunately was able to traverse some 10,000 miles of unexplored south polar waters. The other recent expeditions, *Discovery*, *Antarctic*, *Gauss* and *François* did comparatively little marine exploration within truly polar waters. The *Belgica's* results in this department should, however, be of great interest, and the *Valdivia's* collections,[2] though in more or less extra-polar waters, have important relations to antarctic plankton. A detailed report and discussion of the *Scotia's* plankton is in process of completion by Mr. R. M. Clark, B.Sc.

Of fresh-water unicellular algae little can be said as yet, but they play a very unimportant *rôle* in antarctic plant life. I succeeded in obtaining several diatoms in summer pools on Laurie Island, South Orkneys, while red snow, due to a species of *Sphaerella* and a few patches of yellow snow, due likewise to an alga, were observed at the South Orkneys in autumn. The red snow has previously been recorded from the south, but I am not aware whether the other expeditions observed this yellow snow.

Such in outline is the present state of our knowledge of the botany of antarctic regions, and it will be seen that by far the greater part is due to the labours of the expeditions of the last ten years. Of course such a survey as this must necessarily be incomplete, as several important papers on recent collections still remain to be published, and even when this is done our botanical knowledge of the antarctic will have many gaps: further collections are much to be desired, especially from the Pacific and Indian sides, whence practically nothing is known, beyond

[1] *On the Nature of the Dissemination of the Arctic Seas*. Robert Brown. *Trans. Bot. Soc. Edin.*, ix. p. 244.

[2] *Das Phytoplankton des Ant. Meeres nach dem Mat. der Deutschen Tiefsee Exp.*, 1898-99, G. Karsten, *Jena*, 1905.

of course the collections of the *Belgica* and *Français* on the west of Graham Land, and the various collections from Victoria Land. Among the antarctic lands from which no plants are known are Coats Land, Enderby and Kemp Lands, Termination Land (if this long-lost land is identical with Drygalski's reported "high land"), Wilkes Land, King Edward Land, and Alexander Land, though it is quite to be expected that their flora is very scanty since they are more or less covered with ice, and little bare rock appears.

Turning now from the true antarctic regions to the austral or sub-antarctic regions, comprising the many islands that gird the antarctic seas, it must be said that it is here that the most fruitful botanical collections of future expeditions will probably be made. This ring of circumpolar islands includes the following :—Falklands, South Georgia, South Sandwich group, Tristan da Cunha with Gough Island, Bouvet Island, Prince Edward and Marion Islands, the Crozets including Possession Island, Kerguelen, Macdonald and Heard Islands, St. Paul and Amsterdam, Campbell and Auckland Islands, the Macquaries, Dougherty [1] or Keates Island, and Peter Island, with a few others whose existence is somewhat hypothetical. In passing it may be as well to note that I have included all these islands in the general category of sub-antarctic merely for the sake of convenience in this place, and do not intend to imply that on botanical grounds they can be grouped in the same domain : for a discussion of the classification of these islands reference should be made to Dr. Skottsberg's paper (*loc. cit.*). Of these islands the Falklands have been well studied by various expeditions; South Georgia has been recently re-explored by the Swedish Antarctic Expedition; Tristan da Cunha has hardly been exhausted despite the visit of the *Challenger*; Gough Island, on which I had the privilege of being the first botanist to land, would well repay a visit; Prince Edward and Marion Islands, the Crozets, Kerguelen, Macdonald and Heard Islands, are far from well known, except perhaps Kerguelen ; St. Paul and Amsterdam Islands are better known, and the New Zealand group, including Campbell and Auckland Islands, the Macquaries and Antipodes, have lately received more attention. But all would be worth the attention of a careful explorer, especially as regards the lower forms of plant life. The South Sandwich group, Bouvet Island, Dougherty and Peter Islands, are entirely unknown from a botanical or almost any other standpoint. Bouvet Island, according to the *Valdivia's* reports, is entirely covered with ice and is devoid of vegetation : moreover, it offers no landing-place. On the other hand, previous voyagers have given the island a slightly better reputation, Bouvet (1739) and Lindsay (1808) both reporting trees or shrubs (? tussock grass), and Morrell (1823) speaking of small spots of vegetation. Whatever may be the case it well merits a visit, and in view of its probable accessibility at all times of the year, even in a steel vessel, it is to be hoped it will not be long before we have some definite knowledge of the natural history of the island and its surrounding waters. Gough Island, I can assure any intending botanical explorer,

[1] The *Discovery* reported that this island does not exist in its formerly assigned position.

will more than repay a visit, and is not difficult of access, though landing may be a little troublesome.[1]

The six islands lying in the extreme South Atlantic which were discovered and named by Cook in 1775 the South Sandwich group are probably the most neglected spot in all sub-antarctic regions, and no expedition since that of Bellingshausen in 1820 with the ships *Wostok* and *Mirny* has visited them, though several sealers report that they are quite accessible and contain some good harbours, especially one on Bristol Island. Forster, the German naturalist who accompanied Cook, says no vegetation was to be seen, though Cook himself mentions that he observed vegetation to the north end of Saunders Island. Morrell in his somewhat doubtful voyage of 1823, speaking of the islands, says they are "entirely barren." The *Scotia*, on her first antarctic voyage in 1903, passed within twenty miles of Southern Thule, the southernmost island of the group, but thick and boisterous weather prevented a nearer approach, and time was too precious for the southern cruise to admit of delay: on our return from Coats Land in 1904 an attempt was made to reach the group, but continual adverse gales and a shortage of coal caused the project to be abandoned. Nothing is therefore really known of this group, and a large field is open for some future explorer. It will probably be found that all the islands of the group are not barren of vegetation, while their extreme interest from a botanical point of view lies in their position intermediate between antarctic and sub-antarctic zones, the southernmost islands approximating to the antarctic conditions, though doubtlessly not quite so rigorous, and the northernmost islands no doubt having a climate somewhat similar to that of South Georgia, or perhaps a little more severe. In this chain of islands extending through three degrees of latitude one should be able to study the gradual transition from sub-antarctic to antarctic flora in a way which no other part of the south polar regions permits. There is every reason, therefore, to expect that the vegetation of the northern islands will approximate to that of South Georgia, and that of the southern islands, at least Thule and Bristol Islands, will show some similarity to the true antarctic facies. The floral statistics should also prove of great interest, and may throw some light on the vexed question of the origin of southern floras and former land connections. The flora, especially of Traversey and Candlemas Islands, will probably show a distinct South Georgian and consequently South American relationship, but the point of extreme interest to be looked for is whether it will show near relationships to the flora of the Crozets on the one hand, or to that of the Tristan da Cunha group on the other, and it will be interesting to find out how far this Sandwich group flora has evolved, and whether any new and distinct species have originated. The flora of South Georgia has practically no relationships to that of Tristan da Cunha or Gough Island, but a certain affinity with that of the Crozets and other islands to the east, and with

[1] *Diego Alvarez or Gough Island*, R. N. Rudmose Brown, *Scot. Geog. Mag.*, xxi. p. 430, and *The Botany of Gough Island*, R. N. Rudmose Brown, *Journ. Linn. Soc. Bot.*, xxxvii. p. 238.

the antarctic regions properly speaking (of its eighty species of mosses thirteen are also found in the antarctic); its Magellan affinities are naturally very pronounced, yet considering its nearness to Fuegia and the prevailing westerly winds, it is a matter for wonder that more of the South Georgian species are not found there, and that the proportion of endemic species should be so high in respect of mosses, viz. fifty per cent. according to Dr. Cardot's latest determinations. Among its thirteen species of phanerogams are none which are endemic, a fact not a little remarkable considering how, in similarly isolated islands, such as Tristan da Cunha and Gough Island, the endemic species and varieties form a conspicuous element of the flora, while Kerguelen and other islands to the east are also not wanting in this respect. Possibly the relative accessibility of South Georgia to the Magellan Lands accounts for its want of peculiar species, but if this is so the number of endemic mosses does not become easier of comprehension.

The affinities of the flora of the New Zealand group of southern islands with that of Fuegia is another extremely striking fact, and one whose explanation is yet far from being satisfactorily found; but reference must be made to a recent paper of Dr. L. Cockayne's on "A Botanical Excursion during Midwinter to the Southern Islands of New Zealand." (*Trans. N.Z. Instit.*, xxxvi. p. 225).

To a fuller discussion of the relationships of the floras of these southern islands in their possible bearing on the former distribution of land, I hope to return at a later date. In the meantime enough has been said to indicate the nature of the botanical problems awaiting solution in antarctic and sub-antarctic lands, and while future expeditions will naturally choose their routes largely for oceanographical and geographical reasons, there will always be in any land touched at, or for that matter in any sea, sufficient material of botanical interest to be found. The pole-circling islands are more likely to be well explored as the importance of the study of the vast southern oceans begins to attract attention and when the day of simple boyish pole-hunts is over, as will surely soon be the case.

THE TEACHING OF GEOGRAPHY.[1]

By Professor Alex. Darroch.

I have been asked to say a few introductory words in reference to the aims and intentions of the promoters of the exhibition which opens to-night across the way at the Outlook Tower. Before doing so, I think we ought to thank both the organisers of the exhibition, and also those who have forwarded exhibits, for the opportunity afforded us of becoming acquainted with what must be done if we are to make the Geography teaching of our schools real, concrete, and truly educative. For the questions as to the proper place of Geography teaching in schools, and

[1] An address delivered at the opening of the Geographical Exhibition in Edinburgh on July 6.

especially in our Secondary schools and in our Universities, and of the right methods of imparting this branch of knowledge, are receiving at the present day greater and greater attention from all concerned in the work of Education; and an exhibition such as this can do much to enable us to return right answers to these two problems. As instances of the importance attached to this subject, I may mention that the teaching of Geography now forms an important part of the new commercial course recently inaugurated in the Secondary schools of this country; and already we have signs that more rational and educative methods of teaching the subject are becoming prevalent in the schools. Again, to take another instance, it may be noted that under the new scheme for the Training of Teachers it is required of every teacher of English in our Intermediate and Secondary schools that he must produce evidence of having attended a course of instruction in Geography, and further there is provision made for the training of special teachers of the subject, and it is expected that at least in the larger and more important of our schools one member of the staff should have this special qualification, and so be employed in the teaching of the subject in its more advanced stages. Lastly, there has been a movement to establish a Chair of Geography in the University of Edinburgh, and to include the subject as one which may form part of a degree course. In furtherance of this movement, the University Court, in conjunction with the Royal Scottish Geographical Society and the Chamber of Commerce of Edinburgh and Leith, and other bodies interested in the subject, appealed some time ago for subscriptions in order that this object might be attained, and although a considerable sum has been raised, yet further subscriptions are required in order to attain the end in view, but it is hoped that in the immediate future a sufficient sum will be obtained, so that steps may be taken in the ensuing winter to establish, if possible, a Chair in the subject within the University.

In this connection I may be allowed to say a word or two about the strange apathy and neglect of the scientific study of Geography in this country.

In America, in Germany, in other continental countries, the subject is thoroughly studied and in a scientific manner, and in these countries it is recognised that the study of Geography is not only valuable as an instrument of intellectual culture and of mental discipline, but is also valuable from the point of view of the commercial and industrial progress of the nation, and is, further, of the utmost importance to those to whom is entrusted the defence of the country.

Here in our own country, principally because there is current a wrong conception of the nature of Geography, and a narrow impression of the extent and complexity of the subject, nothing has as yet been done to put Geography in its place as a subject eminently suited to be admitted into the University curriculum. The University of Edinburgh was the first of our Scottish Universities to recognise the importance of the subject, and to take steps, in spite of opposition from quarters where help might have been expected, to place it in its proper position, and I sincerely trust that the citizens of Edinburgh and Leith will see

that the efforts of the University and of the Royal Scottish Geographical Society may not be allowed to fail; and that the funds necessary for the establishment of the desired Chair may soon be in their hands.

Various causes have been at work to produce the renewed interest in the teaching of Geography thus manifested. In the first place, it has been clearly realised that the older methods of teaching the subject, which I am sorry to say in some cases still prevail, crammed the memory of the child with a host of more or less uninteresting facts, and did nothing either to feed or to cultivate the imagination, or to train the reason of the pupil. This is true whether the method relied on be mere book knowledge, or whether the teaching be supplemented by the use of the ordinary maps. The latter method was and is certainly an improvement on the former, but yet mere map understanding is not sufficient for the complete comprehension of geographical facts and their inter-relations with one another. Much less is it so if we endeavour, as we ought, to make our pupils realise that the geographical facts of a district condition, and to some extent are conditioned, by the more important natural and social phenomena whose exact study belongs to other but related sciences. For it is only by keeping this latter point of view ever in mind that our geographical teaching can be made real and living to the child. Again, it is being slowly realised that any kind of geographical teaching which trains the reason of the pupil to the perception of the causal inter-relation between physical fact and physical fact is the best medium by which to introduce the youthful mind to the study of the Natural Sciences, and hence it has been well said that Geography teaching may be made the gateway to the teaching of Science; for the subject of Geography, of all school subjects, if rightly taught, may enable a child to realise that the world in which he lives is not a mere sum of facts, but an inter-related system, a cosmos, in which fact is related to fact, and conditions and is conditioned by the nature of the whole. In this connection I may for a moment allude to an opinion held strongly by many educationalists of the present day. They contend that the exact sciences, such as Physics and Chemistry, should be preceded by a course of study having for its object the training of the pupil to perceive the larger and more obvious causal inter-relations existing between the various parts of the Universe; and they further maintain that if we begin to endeavour to lead a young pupil to select out and to endeavour to understand the more minute and less obvious causal inter-relations, before he has undergone a training in the discrimination of the first-named set of relations, then our method is educationally erroneous, and is one not likely to produce the best results in training the pupil in the methods of Science and in the formation of the so-called scientific habit of mind. For in the study of Physical Geography and the allied branches of knowledge, the facts to be observed and the inter-relations to be discerned are easily separated out from the whole of which they form a part, and can be made readily obvious to minds incapable, through immaturity, of understanding the more abstract and intricate system of causes with which sciences such as Chemistry and Physics

deal. However that may be, all are agreed that the study of Geography in the widest acceptance of the term is one of the best instruments for extending the horizon of the pupil, for the cultivating of his imagination, and for training him to reason and to realise the Universe as a system. But a knowledge of Geography is not merely valuable as a preliminary to the more thorough and the more accurate study of the Natural Sciences, it is in many cases necessary for the right understanding of historical facts, and for the thorough comprehension of the history of our own and of other countries. A moment's reflection will enable any one to realise that geographical conditions have largely determined historical change in the past, and that the historical conditions existing at the present can be made completely intelligible only through the prior understanding of the geographical relations. Again, and above all, a full knowledge of geographical facts is necessary for the right understanding of the economic and commercial conditions of our own and other countries. For the localisation of a people and the distribution of their industries within any one country and throughout the world generally can be made thoroughly intelligible only when our Geography teaching has clearly realised this as its ultimate aim, and when the knowledge has been imparted to the pupil according to a sound method. As the final result of our teaching of Geography, we should have made our pupils realise not merely that a certain city or town is placed here or there, but why this is so; not merely that it has such and such industries, but why these industries are located here and not elsewhere; and lastly, they must understand the use and function the particular city plays in the economic and social life of the nation and of the world generally. Only in so far as we have done this can we be said to have taught the subject at all. Further, while the economic and commercial aspect of the subject is so important for a country such as ours, from the narrow utilitarian point of view, that the knowledge and training is necessary for all those who intend in after-life to enter upon a commercial career, yet it is also important from the fact that it is only by a method which endeavours to attain the end of showing the value of Geography for the understanding and interpretation of the economic and social life of a people that we can really educate the child and train his reason. Now the aim of this exhibition is to make us all realise that the teaching of Geography is necessary for the true interpretation of natural and social phenomena; that without the preliminary training which Geography teaching gives, our efforts at imparting Natural Science will be more or less ineffective; that without a correct knowledge of the facts of Geography, our historical interpretation of the past and our understanding of the historical associations of our own times can never be complete; and that the economic and social life of a people is unintelligible except through a knowledge of the physical environment which everywhere and in all times conditions the growth and distribution of a people and the localisation of their industries. Lastly, and above all, the aim of the organisers is to endeavour to bring home to us the unity and inter-connection of all knowledge, to make us realise that Geography teaching is not concerned with a particular set of facts and a particular system of causes, but that

many systems of facts and their inter-relations must be understood if we are to understand the nature of the social whole.

The second, and perhaps the more important, object of the exhibition is to enable us to obtain some insight into a true and sound method of imparting geographical knowledge, and to give us some insight into methods of arousing, maintaining, and sustaining the interest of our pupils in this particular subject, so that as our final aim we may enable them in after-life to comprehend intelligently the social and economic world in which as men and women they will have to take their place and perform their appropriate functions. Now the best method of imparting geographical knowledge is to go direct to Nature and learn from direct observation the causal interaction of physical fact to physical fact, and how the natural and physical features of a country or district determine the social and economic life of the people. This was the method of Rousseau; still more so was it the method of that much greater educationalist, Pestalozzi, in the teaching of Geography. The cardinal principle of the educational method of Pestalozzi was that the symbol should never be given to the child until he had comprehended the thing signified by the symbol, and we are told that once when his own child used a term without a knowledge of the thing signified by it, he wept from sorrow at finding such an example of educational depravity in his own offspring. In his teaching of Geography, Pestalozzi carried out thoroughly the maxim of presenting the symbol only after the thing itself was comprehended. In the once famous school at Burgdorf the children, along with their teacher, explored the country in the neighbourhood of the school, collecting clay in baskets from the river-banks, and on their return modelled out day by day what they had learned of the physical nature of their environment, and of the inter-connection of physical feature to physical feature. Only after this had been thoroughly comprehended from the clay model was a flat map introduced and the relation of model to map explained. In our present-day teaching of Geography this method of going direct to Nature should be employed wherever possible, and especially in the earlier stages, and any other method must be judged good or bad according as it approximates or falls short of the direct method.

But under the altered conditions of our time, and especially in our large towns, the method of going direct to Nature can be followed only to a limited extent, and further the method has limitations in itself which makes its consistent use inapplicable under existing conditions, for it is obvious that the direct method is always limited by the narrow range of the child's environment. Again, the best method of teaching here, as in so many other subjects, cannot be employed in its entirety even if it were possible, on account of the limited time in which the knowledge must be imparted. Hence the direct method must be supplemented by others, and all these subsidiary methods must have for their aim the endeavour to make Geography a real, a concrete, and a living subject of instruction. If the Geography teaching of our schools has only for its results the memorising of lists of names extracted from a book or gleaned from the unintelligent and premature use of a map, then what-

ever we may be doing we are not educating the child. Nay, more, by such methods we not only kill the child's present interest in the subject, but also fail to foster any future or later interest; and in many cases such teaching tends to make the child grow up dull, stupid, and unimaginative, and with reason dormant about the world in which he lives.

It would ill become me, however, at this time and in this place to inflict upon you a lecture on the method of teaching Geography, but before closing there are one or two principles to which I have alluded already, and which this exhibition is meant to illustrate, that I should like to draw attention to. In the first place, the exhibition furnishes many instances of the practical application of the principle that, wherever possible, whether in the teaching of Physical Geography, of Political or Commercial Geography, or the interconnection of these facts with the social and economic facts, we must base our teaching upon what is already known to the child and within his comprehension. Then upon this as a basis we must proceed to form a concrete and living idea of the district or region as a whole. But we must also remember that the mere picturing of a district or of a country is not sufficient; the child at a later stage must be trained to employ his reason in the perception of the causal inter-relations at work. Now, one particular section of the exhibition has for its aim to show how by means of models and diagrams such a concrete picture may be formed in the mind of the child, and how we may train his reason in the perception of the causal inter-relations at work. Another principle, of which the exhibition gives concrete illustration, is that the symbol should follow and not precede the thing signified, and that in particular the understanding and comprehension of a map should be based and follow upon the prior understanding of the reality of which the map is merely a diagrammatic illustration.

But if we limited our teaching of Geography to the mere understanding of the child's own district and of his own country; if our only aim were to make him realise how many factors have to be taken into account in the thorough interpretation of any one region, then we should not attain the highest result, and we should fail to realise all that we should endeavour to do in our Geography teaching. In addition to this, we must further endeavour to lead our pupils to a knowledge and understanding—imperfect it may be—of the world as a whole, and of the relation, position, and place of his own country to the whole. Now this is a second aim of the present exhibition. It endeavours to show how, by the use of models of pictures, of lantern-slides, and other concrete means we may widen the intellectual horizon of the child; how we may extend his range of vision and cultivate his imagination; and how we may deepen and broaden his sympathies.

There are other aims on which, had time permitted me, I might have dwelt, but I shall call attention briefly to one other object which is sought to be attained by the present exhibition. It is not sufficient that we should know how to lead our pupil to understand and interpret his immediate physical environment, nor is it sufficient to know how to make him best realise the place and function of his own country on this

terrestrial globe; we must further endeavour to make him comprehend the nature of the Universe as a whole, and how this planet on which he lives is related to the solar system of which it forms a part, and to the other systems which the starry heavens reveal to our gaze. We may thus lead him to understand the vastness, the complexity, the grandeur, and the mystery of this Universe in which man at times seems to play but a poor and sorry part.

A LITTLE-KNOWN RUSSIAN PEOPLE: THE SETUKESED OR ESTHS OF PSKOV.

By V. Dingelstedt, Corresponding Member of the Royal Scottish Geographical Society.

The ethnical maps of Russia are as yet far from being accurate; their small scale does not usually permit of the indication of minute, but not unimportant details, and besides, there is an obvious tendency to consider as ethnically Russian all those parts of this immense Empire, in which orthodoxy and obligatory Russian usages have been officially introduced in school and church. Many of the readers of this Magazine have probably never even heard mentioned the name of the small race indicated at the head of this paper, and yet it occupies a distinct territory of about 4500 square miles, and its peculiarities have been considered by the Imperial Russian Geographical Society as sufficiently interesting for them to instruct one of their members (the Rev. J. Gurt) to undertake under their auspices the study of the manners, language and literature of this people. In the first part of vol. xli. of *Isvestia* we find an interesting account of this study, the summary of which may perhaps interest our readers. It is indeed very probable that now, when Russia seems about to enter a constitutional path, with greater respect for the distinct ethnical elements comprising it, we shall learn that this Empire is far less homogeneous than we have been inclined to think till now, thanks to the prevalent policy of denationalisation.

The Esths or Esthonians, often mentioned lately in connection with the revolutionary movement in Russia, inhabit a country which extends south of the Gulf of Finland, as far as the rivers Pimja (Piusajogi) and Vo (Wanjögi), tributaries of the lake of Pskov. They at one time (1346-1561) belonged to Teutonic knights, and are now separated into two distinct races: the conquerors—a mixture of Germans, Swedes, and Russians—called Esthlanders, and the conquered original possessors of the soil, which belong to the Finnish race and are called Esths or Esthonians. The eastern branch of the Esths on the Pimja and Vo rivers, converted to Greek orthodoxy, are known under the name of Setukosy (Setukesed), and their country (4500 square miles) is called Setukesia by Russians and Setumaa by the natives.

According to the census of 1897, there are 16,576 Setukesed (8158 males and 8413 females.) The country has no particular attractions, and

is divided by the river Pimja in its middle and lower course into two parts, northern and southern. The first is a low, flat, mostly sandy country, covered partly with marshes and partly with fir woods; the second, more cultivated and better inhabited, is partly of gravel and partly of clay. The climate is considered healthy, though the people suffer from a number of maladies, such as ichthyosis, eczema, tracheitis, dyspepsia, due to uncleanliness and mal-nutrition.

Setukesed are of rather small stature and mostly light-haired; they are very backward in their general culture, preserve an unshaken attachment to their customs and old traditions, and show how useless it is to compel a people by administrative and police measures to accept language, customs and ideas that are foreign to them. According to the Rev. M. Gurt, the Setukesed have preserved their old customs, their songs, their dress, and their old ideas to such an extent that one may rightly judge of their present state from an old Finnish epical poem, "Kalevala." This perfect immutability amidst a progressive environment—for there is a railway traversing the land, and the western brethren of the Setukesed, the Verro-Esthonians, are certainly not so very backward, as is proved by recent political movements in the Baltic provinces—Mr. Gurt ascribes to the fact that the Setukesed have always belonged to Russia, whilst western Esths have long been by turns under the influence of German, Polish, and Swedish dominion. The true explanation is rather to be sought in the circumstance, that the forcible measures of the Russian authorities in the direction of denationalisation have endeared to the minds of the people all that belonged to their language, their songs, and their traditions, and thus have forced them to live on their past in preference to their present.

The Russian ecclesiastical authority interdicted preaching and the performance of divine service in any other than the Russian language, and the people not knowing this language remained away from the church and were thus deprived of religious instruction. Mr. Gurt says that the Setukesed consider religious formalities as a kind of magical performance, and that they do not even know the Lord's Prayer.

The Russian authority for public instruction have likewise prohibited teaching in schools in any other language than Russian, and the natives ask themselves in consequence: why send our children to school? pigs and sheep meet there together: the first grunt, the second bleat, so that they never reach an understanding.

Mr. Gurt certifies that Setukesed do not like Russians; though both orthodox, these people never intermarry, and the disinclination is reciprocal. Among Setukesed only men speak a little Russian, whilst women and children know only their own soft and musical Esthonian.

Setukesed find themselves under the moral and spiritual influence of their western compatriots, Verro-Esthonians, though they are not particularly respected by the last for their backwardness. Otherwise the people have the reputation of being firm in character, tenacious and even obstinate in purpose.

They dress like other Esthonians. The men wear a white or red linen shirt in the Russian fashion above white or coloured trousers; they

have besides a short kaftan, and in winter a sheepskin; they envelop their feet in a piece of coarse linen (*jalgzati*), and wear besides leather sandals (*tsurra*). The women believe that they have preserved the costume worn by the Holy Virgin Mary; besides the skirt, it consists mainly of a long sleeveless blue-fringed kaftan; they have no petticoats; on their necks and breasts they wear a quantity of heavy silver ornaments; they go usually bareheaded, and only on holidays they put on their heads a kind of wreath (*ranik*) made out of many-coloured ribbons, with some streamers descending over the back. Young women, thanks to their light hair, enjoy in the popular songs a poetical designation of *linohiusse linnukese*, which signifies "fair birds."

Setukesed live in small separate huts with vast courtyards, disposed usually so as to constitute small hamlets. Each hut, constructed of wood, includes a barn and an habitable part; the last consists habitually of only one room, furnished with a big stove, some benches, a table, some beds, and in a corner, as with all Russians, holy images. Family life has preserved a patriarchal character; the chief of the house is strictly obeyed by all other members of the household; the women, though rather badly treated, remain meek and submissive; the children marry early and follow in their choice of partner the advice of their elders. The men are inclined to intoxication with strong drinks. They have also some other vices. They are unclean, cruel to their domestic animals, litigious, disposed to steal their neighbours' horses; but with all that they are represented as childishly simple-minded, and naive, kind-hearted, and, though rough and dirty, yet honest and self-respecting. There are always many contradictions in a human heart.

Setukesed are mainly husbandmen; but they have also some small industries besides, such as weaving, the chase, agriculture, fishing, etc.; but in all these respects they seem far behind their western Esthonian brethren. Their commerce, which is of the nature of barter, is unimportant; it consists in buying and re-selling such commodities as wood-tar, earthenware, fish, rugs, and old horses. These latter are killed for their hides. Curiously enough, the Setukesed do not like fishing; they consider this pursuit a dangerous one. "On the water," tells one of their songs, "if men catch fish, they are also caught by fish." "A fisher," says another, "on parting leaves his people at home crying, and he takes with himself his funeral garb."

Perhaps the most interesting thing about this small, almost unknown people is their folk-lore—a splendid collection of ancient national songs, sayings, fables, traditions, which they preserve with admirable fidelity from generation to generation. Deprived of schools, having no religious instruction, no contemporary literature, they contrive to satisfy their intellectual wants and their thirst for wisdom and moral direction in the course of life by the rich heritage left by their more fortunate ancestors. Every Setukesed woman must know her national songs, and for every young woman about to marry this knowledge of national songs and traditions is considered as the best dowry she can bring, for with it she introduces into her new home the wisdom of her parents, and is the joy and consolation of her family. The songs are produced on many

occasions and in the ordinary course of the daily life, but especially on feast days or special gatherings, which they call *Kirmas-ki* (from Kirmes or Kermes), when they consume a good quantity of wine and beer. They have three kinds of songs: ancient (*vana-laulu*), of the epical, mythical, and legendary type; songs used for births, weddings, funerals, and other occasions (these are called *korra-laulu*), and extempore songs (*tsorts-laulu*), mostly indecent and indecorous. The wedding and funeral songs, which bear no trace of Christian influence, are presumed to be of very ancient origin. Most of the songs are performed in recitative. The usual versification is four-foot trochee; sometimes also dactyls of different poetical measures. According to the German observer, Professor von Ettinger, these songs represent very peculiar, primitive melodies. They are often accompanied by some simple musical instruments, such as pipe, reed, flute, horn, etc.

A number of Esthonian songs have been gathered by a German, Mr. Neues, and published under the title *Esthnische Volkslieder*.

GEOGRAPHICAL NOTES.

Europe.

The Colour of Lake Balaton.—We have recently received a pamphlet (*Die Farbenerscheinungen des Balatonsees*) by Herr de Cholnoky, which forms part (section 2 of part v., vol. i.) of a series of scientific researches on this lake. The pamphlet is illustrated by some coloured plates, which give a striking picture of the varying tints of the lake. The causation of these was investigated in much detail by the author, and by means of white discs he found, first, that the transparency of the lake is low, the mean being 0 m. 85, as compared with 5 m. 36 in the Lake of Constance, and 10 m. 2 in the Lake of Geneva. In the vicinity of the bank the disc sometimes disappeared at a depth of only 0 m. 28. The colour of the lake, viewed from above, varies between the colours VI. and XI. on Forel's scale, being most frequently about VIII. The colouring is in part due to the brownish tint of the waters of those tributaries which traverse marshes, and therefore have their waters charged with humic acid. The humus conveyed by these tributaries combines with alkaline substances in the lake water to form soluble compounds which have a yellowish-brown tint. In stormy weather the streamlets carry considerable quantities of lime and magnesia, brought from the hills on the northern bank. These decompose the soluble alkaline humates, and throw down a deposit of insoluble lime and magnesia salts. The lake then becomes bluish, approaching the tint V. on Forel's scale as the mud is precipitated. A similar colour change, with a similar causation, has been observed in certain of the rivers of South America, where the water is clear and brownish when the stream passes through regions furnishing alkalis, and becomes turbid with loss of the brownish tint when it traverses regions where

the rocks furnish lime, humic acid being present in large amount in both cases.

But the total colour of the lake is not solely dependent on the colour of the water itself. It varies also with the state of the surface, which causes a change in the reflection of the light; with the colour of the sky, which is important in the case of such a lake as Balaton, of large size and with low banks; and, finally, it varies with the position of the observer—that is, whether he is stationed on the windward or leeward side of the lake.

Asia.

The Tsangpo Problem.—In connection with the resolution passed by the Council of the Royal Scottish Geographical Society in regard to the advisability of further exploration of the Brahmaputra (cf. this *Magazine*, p. 272), we have received a letter from Professor Guido Cora, the Editor of *Cosmos*, in which he draws attention to a map and article which appeared in *Cosmos* (vol. ix., 1886-8, pp. 161-2). Professor Cora believes that this article and map settled the question of the connection between the Tsangpo of Tibet and the Dibong (Brahmaputra) of Assam, although about 42 miles of the lower course of the Tsangpo remain unexplored. He further mentions various maps published since 1888 which have the course of the Tsangpo corrected in accordance with the map mentioned above. The number of *Cosmos* containing the map may be inspected at the Society's Rooms by any one interested. Professor Cora's letter, however, only serves to emphasise the need for further and fuller exploration of the region.

The Hindustan and Tibet Road.—According to an article in the *Times* steps are being taken to finish the construction of the Hindustan and Tibet road, which was begun in the fifties of last century by the Marquis of Dalhousie, with the idea of constructing a good and substantial highway up to the Tibetan frontier at Shipki.

The present road, as aligned and constructed by Lord Dalhousie, starts from Simla and passes through the Mahasu tunnel, made through the spur of a steep mountain two and a half miles from Simla. It then leads by a picturesque route past Phagu. A few miles beyond Kotghur, or about 60 miles from Simla, the road joins the valley of the Sutlej, which may be heard roaring at a distance of 4000 ft. below the village. An abrupt zig-zag descent of 3500 ft., amidst beautiful woods of pine, oak, and yew, leads to the banks of that noble stream, the longest of the Punjab rivers.

After following the left bank of the river for about 24 miles Rampur is reached. This is an important trade mart. It is built on a terrace and shut in a gorge of the mountains, and with its curious slated roofs and rock galleries has a distinctly Tartar-like appearance. The lofty and precipitous mountains which frown above it leave so narrow a passage for the river and the sun's rays that in November the latter is only visible between eleven and three o'clock. The town has a

population of 3000 and carries on trade with Tibet, Ladak, and Kulu, chiefly in "pashm," or fine shawl wool of the Tibetan goat. There is here a local manufacture of the famous Rampur *chaddars*, which with Spiti ponies and wool form part of the trade, other commodities from Spiti, Yarkand, and Tibet being also brought in to Rampur, and sold to the merchants of the plains. In summer the traffic is comparatively insignificant, though the fairs held in November and May are important. At Wangtu, where the Sutlej is crossed by a bridge, a road branches off, and turning north-west into Spiti, leads by way of Bara Lacha or the Parang La pass towards Leh and Yarkand.

A few miles beyond Urni one of the great wonders of India comes into view, the road having been here blasted through the Rogi cliffs for a distance of four miles at an elevation of 10,000 ft. above the sea-level, a monument not only of the perseverance of the engineers, but also of the skill of the hill men, who during its formation were to be seen perched by hundreds on dizzy pinnacles, boring for blasts, suspended on narrow planks over the abyss, or crawling along a place where a goat could scarcely find footing. In one part there is a perpendicular drop of 1500 ft., with a further steep descent of 2500 ft. to the Sutlej. The paths are so steep and dizzy that the brain reels when the traveller gazes down. It has been described as one of the wonders of the world in road-making. Beyond Rogi, where the pathway is blasted for half a mile through very steep cliffs, one emerges on to a beautiful country, a forest on one side, the snowy peaks on the other, and the bungalow of Chini in front. Ten miles before reaching Khub a great cantilever bridge was recently constructed across the Sutlej. It was opened for traffic in the autumn of 1904 just before Captain Rawling returned by this route to India, but unfortunately proved to be of no use to that officer and his expedition. The timber of which the bridge was constructed was so exceptionally brittle that three weeks before the party arrived the lower beams gave way close to the piers and the whole structure was precipitated with a crash into the torrent below. A new bridge was erected by the villagers, under the directions of Mr. Hart, Deputy Conservator of Forests. It is the same departmental officer, who has now taken in hand the improvement of the remaining section of the road from Khub to Shipki.

Africa.

The Population of Morocco.—In an article in *La Géographie* for May 15, Captain Larras discusses this much-debated question. No census of the country has ever been taken, and estimates of the number of the inhabitants have varied between very wide limits. The problem is a difficult one, for the population is very irregularly distributed, and as European travellers usually follow routes passing through the more fertile regions, there is a constant tendency to overestimate the number. The people tend for reasons of security to group themselves in "islets" in the more fertile regions, but as their methods of agriculture are primitive, even these regions do not support a very dense population,

and the author is of opinion that there are only a small number of districts where a density of 40 per square kilometre is reached over any considerable area. He considers that at the maximum the population cannot exceed 5,000,000 for the whole country. In detail he gives the following figures:—The Sahara of Morocco, 500,000; the region of the Atlas and the Riff, 1,900,000; the Atlantic region, 2,200,000; total, 4,600,000.

The Alexander-Gosling Expedition.—Those who have followed here the course of this expedition across Africa will regret to learn of the death of Captain Gosling, which took place in Central Africa from blackwater fever on June 13. This is the second death in the party, as it will be remembered that Captain Claud Alexander died in November 1904.

America.

Earthquake in South America.—While the interest in the San Francisco earthquake is still active, there comes news of another great outburst of seismic activity. On August 16, at eight o'clock in the evening, a great earthquake occurred between Valparaiso and Talca, followed, like that of San Francisco, by destructive fires. It is stated that the disturbance extended over a zone of nearly two degrees, and that there were two distinct shocks, of which the first lasted 3½ minutes and the second 20 seconds. A large part of the town of Valparaiso was destroyed and Santiago de Chile was severely damaged. The loss of life and damage to property were great.

The New Madrid, Charleston and San Francisco Earthquakes.—In a paper read before the Geological Society of Washington by Mr. M. L. Fuller (cf. *Science* for June 16), the comparative intensities of these three earthquakes was discussed. The New Madrid earthquake took place in 1811-12, and the Charleston one in 1886. Considering first the area disturbed by fissuring, we find that such phenomena are reported to extend at least 125 miles north and south of San Francisco, over a width of 50 miles. In the New Madrid earthquake, the belt was about 110 miles by 60, and at Charleston it was only 30 by 20. On the other hand, at San Francisco the fissuring was only reported at widely separated points where the conditions were particularly favourable, while in the two other areas the entire surface within the limits named was affected. In both the Charleston and San Francisco cases the severe tremors were limited to a few hours, while at New Madrid they continued at short intervals for over a year, nearly 2000 shocks occurring in the first three months. The effect on buildings was also greatest at New Madrid, even low buildings being shaken down. Further, owing to the magnitude of the surface undulations, at New Madrid considerable areas of forest were thrown down even on the level ground, and the bluffs were literally shaken to pieces, the resulting landslides converting them into jumbles of earth-heaps and tree-trunks

for a distance of 100 miles. Such landslides occurred occasionally at San Francisco, but on a smaller scale, and were absent at Charleston.

Again, while tidal waves were absent at Charleston and San Francisco, at New Madrid the Mississippi was disturbed by great waves. Cracks and craterlets, with possibly one or two exceptions, were absent at San Francisco, but were common at Charleston and New Madrid. Craterlets abounded at both places, but as regards the amount of sand and water thrown out, those of New Madrid were by far the more important. In this area also many of the streams had their courses altered. From other lines of evidence also it seems clear that every type of earthquake phenomena was more pronounced at New Madrid than either at Charleston or at San Francisco.

The New Madrid earthquake is believed to have been due to faulting produced by local overloading of the crust by the Mississippi embayment deposits. Evidences of prehistoric disturbances have been found, and it is known that readjustment is still in progress. In the future, shocks are to be expected in this region, which may affect the small towns near the Missouri-Arkansas line, and possibly Memphis, Cairo, and St. Louis.

The cause of the Charleston disturbance was probably similar. The San Francisco shock was due to the readjustment of one or more faults due to mountain-building forces which have been long in operation. Though a new position of equilibrium may have been temporarily established, yet new disturbances are likely to occur in the distant future in this region.

Polar.

Suggested Arctic Expedition.—In the *Bulletin de la Société Royale Belge de Géographie* (No. 2, 1906), M. Charles Benard puts forward a new scheme of Arctic exploration, which has for its object, not the reaching of the Pole, but the thorough investigation of the meteorological and hydrological conditions prevailing in the Polar basin. The method consists, in brief, of the repetition, with certain modifications, of Nansen's drift in the *Fram*, but M. Benard considers that two ships should be employed, and that these should endeavour to become fast in the ice at a distance of 50, 60, or 80 miles from one another, while remaining in communication by wireless telegraphy. It is obvious that in this way the value of the scientific observations made would be greatly increased.

In detail M. Benard's scheme for the drift is as follows, and the suggested course may be readily followed on the chart which accompanies Dr. Nansen's paper (see *S.G.M.*, xiii., 1897). The start would be made from some Norwegian port, preferably Tromsoe, in the middle of July, and the sister ships would be accompanied at first by a coal transport. The southern part of Barents Sea would be traversed, and then the Yalmal peninsula rounded between the pack and the mainland. Fresh provisions would be taken in either at Khabarova or at Port Dickson, together with dogs and other supplies. An attempt would then be made to round Cape Chelyuskin in order to reach the north of the New Siberian Islands, which it is supposed would be reached in the autumn.

These islands being reached, in place of turning direct to the north, as was done by the *Fram*, an attempt would be made, at whatever cost, to reach a point situated on the parallel of 150° E. long. Arrived here the ships would allow themselves to be caught in the floe-ice, and the drift would begin. It is possible that entering at such a point the vessels might drift over the Pole, and there is even a possibility that one of them might drift towards Robeson Channel. In any case the traverse must yield great additions to our knowledge of the conditions in the Polar basin.

The Movement of the Antarctic Inland Ice.—In the first number of one of the latest additions to geographical literature—the *Zeitschrift für Gletscherkunde*—there appears an interesting note by the Antarctic explorer, Professor E. von Drygalski, on the movement of the inland ice, based upon the observations of the German Antarctic Expedition. It is of course a familiar fact that the icebergs of the Arctic are very different in appearance from the peculiar tabular bergs of the Antarctic. The causation of the difference appears to be that, for at least the most part, the inland ice of the Antarctic presents a uniform front to the ocean, the coast of Victoria Land being an exception. On the other hand the ice-streams of the Arctic as they approach the sea are constrained to pass between the rocky walls of the fiords. One result of this is that the ice-streams acquire in the fiords a relatively rapid rate of movement, as much as 18 metres in twenty-four hours, for example. In the vicinity of Kaiser Wilhelm II. Land, where the German station was placed, the ice approaches the sea with an uninterrupted front, and has a very much slower rate of motion. Very elaborate measurements of this rate were taken by the members of the expedition. The results have not yet been fully worked out, but the main conclusion is that at the margin of the ice-cliff the movement in five months was only about 50 metres, giving a daily average of only a third of a metre. As in Greenland the rate of motion diminishes in passing upwards from the margin inland, but the rate of diminution is much less—about 4 cm. in 2 kilometres, or about one-eighth of the total, as compared with 4 m. in the same distance in Greenland, or about one-fourth of the total. Both the difference in the rapidity of motion, and in the variations of rate, must be ascribed partly to the difference in the thickness of the ice-cap at the spots measured in the two hemispheres, and also to the fact that the ice-stream in the south is not constricted but spreads out like a broad river. The consequence, as indicated above, is that the bergs of the south are remarkably uniform in shape as compared with the very varied bergs of the north. In the Antarctic the ice spreads out over the sea bottom, and calves off bergs as soon as the depth becomes too great for it to remain upon it. The causation of the movement seawards, as in the Arctic, seems to be due to the squeezing out of the lower layers of ice under the pressure of the upper layers.

General.

The European in Tropical Climates.—In an article entitled "An Essay on the Psychology of the European in Hot Climates," Dr. Ad. Cureau discusses in the *Revue Générale des Sciences* (April 30, and May 15, 1906) a subject of prime importance. At the present time we may say in general terms that the blank places on the map of Africa have been filled up, the work of exploration is virtually over, but in spite of the partition of the continent among the nations of Europe, there are enormous regions where the effect of European occupation is infinitesimal. Is Africa destined to be conquered by the civilisation of Europe? The progress of medical science in regard to the discovery of the causation and prevention of the important tropical diseases inclines many to say yes, but the work is yet only beginning. Behind and beyond all the obvious difficulties of transport, of climate, of disease, of food-production, and so forth, is the deeper difficulty of the physical, moral, and mental degeneration which so frequently attacks the white man in the hotter regions of the continent. In the article mentioned above the author discusses the symptoms and causes of these degenerative changes, from a purely scientific standpoint. The subject is one of great interest, not only to the scientific geographer and the colonist or official, but also to all those who by their votes or otherwise have to pass judgment upon the administration of distant dependencies. Dr. Cureau's own opinion appears to be that—in Africa at least, the country to which he especially refers—the best qualities of the European can only be retained where the conditions admit of the presence of some part of what may be called the apparatus of civilisation. Where this is absent, and where individuals or small groups of Europeans are isolated for considerable periods among barbarous surroundings, he appears to consider that moral degeneration is almost unavoidable. In other words, it seems that the problem—Will tropical Africa or the European conquer?—will not be solved even if modern medicine triumph over the important tropical diseases. In a recent *Note* here (p. 216) we quoted a statement indicating the important part played by flies in keeping Africa free of immigrants, but Dr. Cureau makes it clear that it is not only the disease-carrying Diptera which have to be conquered before the continent of Africa lies open to all. We recommend the papers to the notice no less of the geographer than of the citizen with strong opinions on the administration of tropical dependencies.

Bird-Migration and Geography.—In an article in the *Journal of Geography* (April, 1906) the migration of birds as a subject for geographical study is discussed, and the author shows how certain representative migrants might be taken as the text of an interesting series of geography lessons. As an example he takes the very striking case of the American golden plover, which nests in the "barren grounds," far above the tree-line, and spends the months from September to March in South America, travelling thither *viâ* the Bermudas, the Antilles, and the Sargasso Sea. This migration might form the basis of a series of

lessons, in which the contrasts as regards physical conditions of the different regions traversed might be impressively brought out. The subject is, of course, one which might be happily treated in connection with nature-study courses, and British examples of migrants as interesting as the one named above are not wanting. Teachers desirous of adding to the interest of their geography lessons may be recommended to read the original article.

The Naples Marine Station.—An article in the *Nuova Anthologia* for June on this famous station, in addition to a discussion of various points connected with the establishment, which are doubtless more or less familiar to most persons interested, gives also some figures which it is worth while to emphasise. Of the thirty-seven tables to be let at the station, eleven are taken by Germany, two by Austria, one by Hungary, one each by Belgium and Holland, one by Switzerland, four by Russia, three by Great Britain, four by the United States of America, while the remaining nine go to Italy. The three tables which are maintained by British sources belong to the two universities of Oxford and Cambridge and to the British Association, and the number seems small when we recollect that the United States, with all her own stations, and despite the great distance, maintains four tables. No fraction of the sum required to maintain the three British tables is contributed by the Government. The work carried on at the station is not only of zoological interest, but also of geographical, and—in its connection with fisheries—of economic value.

Geography at Edinburgh University.—According to a communication from Sir William Turner, the Principal of the University of Edinburgh, the King in Council has approved of the Ordinance which makes Geography a subject of study for the Arts Degree.

Commercial Geography.

Tea-Cultivation in the United States.—According to Dr. Rodney True, a paper by whom is summarised in a recent issue in *Science*, both the Government and private individuals have been giving a considerable amount of attention to the tea plant, with a view to ascertaining whether it can be profitably grown in the States. In South Carolina, partly with the aid of the Government, detailed experiments have been carried out, with the result that last season five and a half tons of high-grade tea of native growth was put upon the market. Not only has the plant been successfully grown, but attention has been given to labour-saving devices, with the result that a large part of the work necessary in the preparation of tea can now be performed by machines, with a considerable saving of the cost of production. Another tea-farm has been established in Texas, and some samples of the product from young bushes have proved to be of high quality, but as yet this farm is only in the experimental stage.

Railways in Madagascar.—In an article in *Questions Diplomatiques*

et Coloniales, some account is given of the so-called "rice" railway in Madagascar, which is to connect Tananarive with the coast. The district of Emyrne, owing to abundance of water and the numerous valley-floors, is admirably adapted for the cultivation of rice, though this plant has hitherto not been cultivated to any great extent, on account of the absence of a market. Yet, extraordinary as the fact may seem, the inhabitants of Tamatave actually use Saigon rice, finding it cheaper to import this from Indo-China than to obtain it from the interior of the island. The explanation of this lies in the relief of Madagascar, and the difficulties of communication between the littoral and the interior. So bad was the native path that twelve to fifteen days were formerly required for the journey between Tananarive and Tamatave, and the cost of transport varied from 1200 to 1600 francs per ton. After the French annexation the first thing was to improve the road, and in this way the cost of transport was diminished from about a half to two-thirds, but even this was not sufficient to permit the rice of the interior to be brought to the coast at a cheaper rate than it could be procured from Cochin-China. In consequence a railway scheme was taken in hand, and at present 150 kilometres of the line have been constructed, and connect the towns of Brickaville and Antanijona on the Mangoro river, while the remaining 100 kilometres are well advanced, and it is expected that the rail will be connected up to Tananarive before the end of 1907. The section already completed is that which covers the most difficult part of the country, and the only remaining difficulty is the ascent of the Angavo range. But here the carriage road runs side by side with the railway, which is a great advantage, and labour is readily available, in view of the fact that the Hovas can be employed, whereas on the lower levels it was found impossible to acclimatise them.

By the aid of the existing portion of the railway, the motor-car service on the road, and the "Pangalanes" canal, the distance between Tamatave and Tananarive has been already shortened from fifteen to three days. The canal merits some notice. It utilises a series of lagoons separated from the sea by a narrow ridge of sand, on which formerly the road ran, and connects Andevorante and Tamatave. From the railway terminus at Brickaville goods are transported down the Lower Vohitra to Andevorante, thence by the canal to Tamatave. The marginal lagoons were formerly separated from each other by the so-called "pangalanes," which are narrow belts, of feeble elevation, connecting the coastal sand-bank with the land at the inner side of the lagoons. It was only necessary to pierce these belts by canals to produce an uninterrupted channel of water along the coast. This channel ends at Ivindro, whence a short line of 12 kilometres in length connects with Tamatave. Probably later this channel will be prolonged southwards in the same way, and thus serve as an efficient and protected waterway for all the ports of the coasts, which are for the most part rendered difficult of access from the sea by the bars which guard them.

In addition to rice it is hoped that the new line may carry other produce from the interior to the coast, and thus play an important part in the development of the country.

NEW BOOKS.

EUROPE.

Eleusis: Her Mysteries, Ruins, and Museum. Translated from the French of Demetrios Philios by Hamilton Gatliff. London: Sydney Appleton, 1906. *Price* 3*s.* 6*d.*

There are few questions connected with early Greek history that are more suggestive of interest and yet more elusive than that concerned with the origin and import of the "mysteries." Of these mysteries or mystic festivals there were many in the townships of Hellas, but the most famous was the Eleusinian, which can be traced from its simple beginnings at Eleusis, twelve miles from Athens, in or before the seventh century B.C., through its development under the Pisistratids and later Athenian influence from a local cult to a Pan-Hellenic ritual. As ritual these mysteries retained their position till they were abolished by the Emperor Theodosius towards the end of the fourth century A.D.

This little volume presents the reader with a clear resumé of our existing knowledge as to the mysteries, whether derived from classical literature or excavation. We seem to trace in them the union of three streams of tendency, distinct but not dissimilar: ancestor-worship, connected particularly with the name of Triptolemus, the old Eleusinian King; the worship of the Underworld, seen principally in the worship of Iacchus; and the clinging belief to the permanence of life after death, which finds its expression in the representation of the descent of Persephone into the lower world, and of her return to the light of day and to her mother, Demeter. As to the influence of the mysteries one or two things seem clear: they did not inculcate any esoteric dogma, but confined themselves to presentation of sacred objects and to representation of actions, the latter probably in dumb show: the number of those initiated into these and other mysteries was, and continued to be for centuries, very large, and their general religious effect may perhaps best be summed up in one pregnant sentence, "The initiated learned nothing precisely, but they received impressions, they were put into a certain frame of mind."

This is a most interesting volume both to the antiquarian and to the student of the development of religious life.

Pictures from the Balkans. By John Foster Fraser. London: Cassell and Co., 1906. *Price* 6*s.*

Nothing but praise hitherto seems to have been given to this book. And as a collection of newspaper articles, it doubtless deserves the praise. The author's direct, matter-of-fact style suits the present-day taste. Apart from this, his style, the subject matter is most interesting. It is indeed probably the most interesting as well as the most complex (in regard to races, languages and political outlook) in the world. In a short space (both of time of travel and of bulk of book) he goes over a vast ground, and touches on nearly all the great problems. But as a contribution to Balkan knowledge he adds nothing. As an observer he has his eyes open, and is candid and impartial. But one must have more than open eyes; one must have mind prepared, before one goes into such a region, to do justice to it. He makes many discoveries and admissions, but these have all been discovered long ago, and admitted by all who know the ground. He hits upon the broad distinguishing characteristics of the various peoples very fairly—finding the Servians simple, boorish, and generally rather *gauche*; the Bulgarians dour, sullen, but assimilative; the Turks reserved, suspicious, but refined; the

Albanians bold but honourable. With regard to the Macedonian troubles, he does not ignore, as so many do, the fact that the Turkish element is necessarily the most important—one half of the people being Moslem, and just as good and industrious as Bulgarians or Greeks. He shows again and again, and sometimes most touchingly, how Turks and Christians live together, when not interfered with, in perfect amity, emulous only in hospitality.

When he says that the Balkan situation "has entered a new phase," in that the Christians now hate each other more than the Turk, he is not speaking "by the book," for they have *always* done so. When he finds in Lower Bulgaria pleasanter scenes, kindlier manners, happier people than in Old Bulgaria, and notes that the people remain mostly Mohammedan still, he does not place to the credit of Turkey as much as he ought. What he says in Chapter xv. about the Turk as a man, a host, a gentleman, with a certain "cachet of distinction" about him; and about the Turkish soldier as devout, honest, faithful; and also about the Turkish Government (as distinct from the Turkish people) as hopelessly hampered in the impossible task of trying to fit an old Oriental régime into modern ideas—has all been said before to unwilling ears. It is well, however, to have it said again so pointedly.

Historically, archæologically, and ethnographically, he is often wide of the mark. He should know that the good reason why the Turks do and must support the Greek Orthodox Church as against the Exarchist (Bulgarian) Church, is the old compact struck centuries ago at the fall of the Byzantine Empire between Sultan and Patriarch. We think he saw no "Roman remains," but Græco-Roman, at Ochrida. We are sure the bridge over the Skumbi, up from Elbassan, is not Roman, but Turkish. We saw only a few Roman stones there in the lowest part of the north pier. The same remark applies to those at Berat, Tepelini, and elsewhere in Albania and Roumelia. The Turks were once great and beautiful builders. We do not think the rough broken cobble-stone pavement (*selciata*) is Roman either. It is common over all those mountainous regions—Albania, Montenegro, Bosnia.

He should have been chary, also, of deciding what none exactly knows—the origin of the Albanians. They are certainly not the mongrel set he makes them out, split up into as many tribes as there are valleys. North of Elbassan latitude they are Ghegs; south, Tosks. Their language (Gheg and Tosk being akin) is not "bastard and formless," but has a grammar, and is rich in martial and erotic songs. Greek (Romaic) also is spoken all over the Tosk country. He errs when he speaks about people calling themselves "Greek," as at Koritza, merely for safety's sake. They all do so there, by general custom and tradition, from Koritza latitude southward. To explain why they call themselves "Græcoi," not "Hellenes," would be to go deep into ethnology indeed.

There is little of direct geographical value in the book. The author notices the vast flat plain of Thrace, dotted with tumuli, and surrounded by high mountains. Tradition says those tumuli commemorate great battles. But scientific research alone can decide. They resemble the tumulus at Marathon, but are larger. He notes the perilous tracks, the comfortless khans, the picturesque towns, the gloriously wild scenery of Albania; but we can hardly say he *describes* them. For detailed description we refer the reader to Vol. xv. No. 7 of our *Magazine*. His "Kjuks" should be Cukutz (the Khan above Skumbi). His "Tomorica" should be Tomoritcha, Tomerit, or simply Tomor (mountain above Berat). And Elbassan is not the murderous place he represents—twenty to thirty murders in a year, not a week, is the utmost stretch. There are also several other mistakes which we have noted.

Our Waterways: A History of Inland Navigation considered as a Branch of Water Conservancy. By URQUHART A. FORBES. London: John Murray, 1906.

In view of the growth of interest in inland water transit, this volume should be welcome to all who wish to obtain, without too much trouble, a general grasp of this important subject, both in its historical and practical bearings. Inland water transit is, no doubt, less practicable in a hilly country like Scotland than in many parts of England, and although a few of the Scottish canals, such as the Forth and Clyde, yield a fair revenue, the greater number have proved financial failures on this side of the Tweed, and there is not much brought forward here calculated to revive the lack of interest with which our canals have for a long time been regarded. Geographically, however, the subject is interesting even to Scotsmen, to whom no likely avenue for more commercial enterprise should be neglected.

In this connection the author does well to remind us of the interesting geographical circumstance that the United Kingdom possesses a peculiar advantage over Continental countries in the number of its tidal rivers, whose flow and consequent value for maritime trade is immensely greater than those, like the Danube, that enter a tideless sea. The tidal coastline in Great Britain of 3900 miles is greater than that of any other nation in Europe (p. 14).

Although there were navigable waterways in England as far back as 1563, when the first lock was constructed on the Exeter Canal, the real canal era cannot be said to have begun till 1761, when Brindley constructed for the Duke of Bridgewater a canal twenty-nine miles in length, to convey coal from the Duke's estate at Worsley to the city of Manchester. The interest and success of this undertaking led to the construction of a succession of large canals all over the United Kingdom, ending with the Manchester Ship Canal, which now incorporates the Bridgewater Canal within its system. Indeed, in 1792 there arose a canal mania like the railway mania of half a century later, but on a smaller scale. The first Scottish canal, 33¼ miles in length, running between the Forth and the Clyde, was begun in 1768 and completed in 1790 at a cost of £150,000. It was followed by the Crinan Canal, begun in 1793 and finished in 1801. The Caledonian Canal, the first survey of which was made by James Watt so far back as 1773, was not actually commenced till 1804. It was completed in 1822 at a cost of nearly a million, but it never proved a financial success. It fell into decay in 1837, and was repaired and reopened in 1847, but its numerous locks prevent modern ships of large size from using this route, and the receipts from the smaller craft that frequent it scarcely even meet the annual cost of maintenance. When railways appeared canals began to wane, and indeed many of the canal companies seem, like other capitalists of the time, to have been carried away with the railway mania, and in many cases they put pressure on railway companies to buy up the canals. The railway companies now control one-third of the 4764 miles of canals within the United Kingdom, and while the mileage of the railways is more than four times as great, their capital is thirty-two times that of the canal companies, very few of which are now earning remunerative profits.

In spite of these very plain and depressing facts, the author advocates the resuscitation of the canals, and points to the superior economy in upkeep and transport power over railways, and the good results attending the recent development of canals in some countries on both sides of the Atlantic. He thinks the canals should be nationalised and managed by a powerful Government trust or water conservancy board that would have charge of the regulation of all water that falls on these islands, from the time it arrives from the clouds till it finally reaches

the ocean! That is rather a large proposal for this individualistic people to accept. But the matter, whether practicable or not, is worth attention, and the outline given in these pages should be studied in connection with present day movements towards the improvement of agriculture and the restoration of rural industries, the success of which so greatly depends on the cheapness and facility of transit between the producer and his market.

ASIA.

Le "Far West" Chinois: Deux Années au Sechouen. Par Dr. A. F. Legendre, Director of the Imperial Medical School of Sechuen. Pp. 537. Paris: Plon, 1905. *Price 5 frs.*

Sechuen is that large province which separates Tibet from China proper. Its area exceeds that of France. The author was sent there in 1902 by the French Minister of Foreign Affairs, and, after learning Chinese, founded at Cheng-tu a medical school which he directed for two years with only the aid of his wife and an infirmary assistant. "This long residence," he remarks, "in the heart of China, with my daily intercourse with all classes, from the coolie to the mandarin, enabled me to observe everything with ease, particularly as my students, aged from eighteen to twenty-five, did not fail to let me see, as youths always do, the best and worst qualities of their race. The Chinaman's confidence," he says, "is not easily won, but once gained he exhibits a civility, an exquisite urbanity, even an affection, which makes him willingly work with a European." The volume before us is divided into four parts, the first describing the ascent of the Yang-tze, and the voyage from Chong-keng to Cheng-tu through marvellously beautiful scenery; the second describing Western Sechuen and its alpine regions; the third discussing Chinese civilisation in the family, social classes, arts, industries, etc.; and the fourth describing the races of Sechuen, so different from those of real China, the productions of the soil, and the commercial and industrial prospects of the province.

Marco Polo resided for a considerable time in Cheng-tu when it was a greater city than at present, although, with suburbs, it has a population of 450,000. Each street in it is separated from others by gates and walls erected for protection from the robbers who infest Chinese towns, and all streets are very narrow and in winter liable to inundation by rains. Each street is also occupied by tradesmen of a particular class who are occasionally subject to tyrannous guilds. Butchers and tanners occupy the Mussulman quarter. In the institution termed the Kuen Kong Ku seven or eight hundred deserted orphan children, from ten to sixteen years of age, are taught all kinds of trades, and the author, as its medical superintendent, introduced hygienic and orderly administration, two things usually unknown in China. There is likewise a university, and a military school, directed by Japanese, with about two hundred scholars. The medical school organised by the French Government occupies a mandarin's house. For some years the city has had an arsenal where guns after European models are manufactured. There are neither tramways, omnibuses, nor carriages, but men carry palanquins, or draw rickshaws. The author gives a lively description of the usual scenes in a Chinese street, observing that "in their joy and their amusements, the Chinese of Cheng-tu always display the same calm and serenity, the very children being rarely noisy or clamorous."

In the author's chapters on Chinese civilisation, the result of a study of two years' duration, he dwells on the terrible isolation of the Chinese family, in which the father is a demigod with power to sell his children as slaves and the

right to put them to death. The mother does not count. Daughters are despised and daughters-in-law are maltreated. Houses, like clothes, have been the same for thousands of years. People do not undress after the commencement of winter, which at Cheng-tu lasts six months. Most of the people there carry all they possess on their backs. Pork is their favourite dish, especially the fat. The Chinaman is not an agriculturist, but he is an excellent gardener, utilising every inch of ground. He is also an unscrupulous small tradesman, adulterating everything he sells.

There exists in China an all-powerful aristocracy, the aristocracy of science, which calls itself the "lettered class." They alone have a right to Government appointments and honours, and they alone can hope to make a position in the Empire, or wield any influence there where "the citizen is not yet born" and the ignorant have a religious veneration for the lettered. In a country where corporal punishment is frequent, the "chen se" (lettered one) alone escapes it. He is the great local authority, and even mandarins bow before the "tou chou jen" (the man who has studied books). He is dressed in a particular way and wears long nails to show that he never uses his hands. Swift must have got some ideas for his *Gulliver's Travels* from reading accounts of the Chinese lettered aristocracy, such as Dr. Legendre brings before us in this instructive and amusing book. German officers visiting Cheng-tu were considered unlettered coolies by the Chinese because they walked about dressed in khaki and did not drive in carriages.

The Journal of John Jourdain, 1608-1617. Edited by William Foster, B.A. Cambridge: Printed for the Hakluyt Society, 1905.

The latest publication of the Hakluyt Society deals with the first years of the seventeenth century, one of the most interesting periods in the annals of English enterprise in the East. It contains the journal of one, John Jourdain, who took a prominent part in several of the expeditions despatched by the East India Company. In the beginning of the seventeenth century Portugal and Holland were in deadly rivalry for the profitable trade of India, the Straits, and the Spice Islands; England joined in the scramble, and Jourdain, although he did what one man could do to thwart the Portuguese and the Dutch and to establish rival factories, had not the good fortune to see his efforts crowned with success. Indeed at the time of his death the fortunes of the English adventurers were almost at their lowest ebb.

The date of Jourdain's birth is doubtful; but Mr. Foster in his exceedingly interesting and erudite introduction gives good reasons for assigning it to the year 1572 or 1573. He was born in Lyme Regis in Dorsetshire. As a young man he seems to have travelled to Portugal and the Azores for the purposes of trade, but in 1607 he gave up his private business and entered the service of the East India Company on the modest pay of £3 a month. We must remember, however, that all the Company's servants were permitted to trade on their own private account—a lucrative privilege, which made their remuneration from the Company of not much importance. These were the days of what are known as the twelve "Separate Voyages." The first under Lancaster in 1601, sailed for Achin and Bantam, and returned home in 1603 with a cargo of over a million pounds of spices, part of which had been looted from Portuguese ships.

The success of the expedition, looked at simply as a commercial speculation, was conspicuous, and other similar expeditions were speedily taken in hand. But the system of separate voyages was "cumbrous and mistaken." It was Jourdain's bad luck to join the fourth of the "Separate Voyages," which, leaving England

in 1608, was the most unfortunate of the whole twelve, as both the ships concerned in it were lost. He was chief merchant of the *Ascension*, the commander of which, Alexander Sharpeigh, had orders to proceed to Madagascar, Aden, and Mocha, and thence, if need be, to Surat or Laribandar; in the last resort he was to go to Bantam and the Moluccas for pepper and spices. Notwithstanding the prohibition of the Company, it was found necessary to land at Table Bay at the Cape for water. There they lost two valuable months, and very soon after they again made a start, the vessels were separated by bad weather never to meet again. The *Ascension* was driven to the Comoro Islands, thence to Pemba, and thence to the Seychelles, at that time uninhabited, but with abundance of fresh water, fruit, fish, fowls, etc. In April 1609 the *Ascension* reached Aden, "the first English ship to visit a place that was destined to become an important outpost of the British-Indian Empire." Aden in 1609 was an important military outpost of the Turkish Empire, and near it was Mocha, equally important in the matter of trade. The adventures of the commander of the *Ascension* and his outmanœuvring of the wily Greek Governor of the fortress are one of the most amusing and interesting episodes in the journal. One result was that Jourdain and three others were sent by the Governor to the town of Sana in the interior of the Yamen, where they met with an unexpectedly gracious reception from the Pasha, who acceded to their request to be allowed to sell their goods but refused permission to establish a factory, or even to return to the country without express licence from Constantinople. With this concession they made their way to Mocha, where they found the *Ascension*, and soon set sail for India. In passing we may remark, that apparently the unanticipated journey of Jourdain and his companions to Sana in the Yamen has escaped the notice of the learned author of the *Penetration of Arabia*. He mentions, indeed, the arrival of the *Ascension* and Sharpeigh in 1609 at Aden, and adds that he (Sharpeigh) "did little but irritate the Turks." He says nothing of Jourdain being sent to Sana, and seems to imply that Middleton and his crew, who were entrapped and captured by the same Greek Governor of Aden and sent to Sana in 1610, were the first Englishmen who experienced such a fate.

The luckless *Ascension* was wrecked on shoals opposite the mouth of the Ambika river and had to be abandoned. The ship's company got on shore in boats, were well treated by the natives, and made for Surat. When entrance into that city was refused by the Portuguese, they decided to proceed to Agra, where Hawkins, who had gone out with the "Third Voyage," had already established more or less satisfactory relations with the Emperor Jehangir, son of the famous Akbar. At first Jourdain remained with Finch in Surat, but afterwards he also went on to Agra, *viâ* Burhanpur and Mandu. From his journal it is not difficult to trace his route either to or from the Mogul capital, and some of his descriptions of the places he passed through are exceedingly interesting. He remained in Agra some five months, at the end of which time the party returned, *viâ* Ajmere, Jodhpoor, and Ahmadabad; but on reaching the coast they found a cordon of Portuguese ships and troops between them and Sir Harry Middleton's ships, *i.e.* those of the "Sixth Voyage" which had left England in 1610. Jourdain, however, eluded the cordon and got on board the *Peppercorn* without serious mishap. Then followed much negotiation and intrigue with a view to inducing the local authorities to permit the English to establish a factory in Surat, but all in vain, and Middleton in disgust sailed away in February 1612 to the entrance of the Red Sea, where he practically turned buccaneer, and captured many ships, the contents of which he confiscated. Just when he had secured a satisfactory booty, the ships of the "Eighth Voyage" arrived on the scene, and the commanders of the squadrons at

once quarrelled violently as to sharing the spoil. In the height of the trouble, Jourdain sailed for Tiku in Sumatra in search of pepper; the main body of the ships followed later on, but as trade was bad they moved on to the Bay of Bantam. There Jourdain was promoted to the command of the *Darling*, and despatched to Amboyna. There he had to measure himself against a different power, viz. the Dutch, who were straining every nerve to acquire and retain the monopoly of trade in the Spice Islands. When Jourdain arrived he found the local chiefs thoroughly discontented with the Dutch, as the latter, with characteristic folly and cupidity, had reduced, by nearly fifty per cent., the price they had originally paid for cloves, and he was welcomed with effusion. But in the presence of the Dutch factors and merchants, the chiefs were too timid to sell, or rather to deliver, much cloves to the English, so the *Darling* set sail again for Bantam, having accomplished little.

On the way to Bantam he visited the island of Buton, with a view to possible trade, but Jourdain did not think it worth while to set up a factory there; on the other hand, he did establish a factory at Macassar. On arriving at Bantam, he found the principal ship, the famous *Trade's Increase*, lying aground on the shore, his friend Middleton, the leader, and 140 of her crew dead of disease, and a furious quarrel going on among the merchants on land. After a very short stay, Jourdain set sail for Masulipatam, but on the way there he fell in with the ships of the "Tenth Voyage" on their way to Bantam, and with them, much against his will, he returned. He was appointed head agent for the Company, and in this capacity he did good service in checkmating the Dutch, and in expediting the transmission of spices and merchandise till the end of 1616, when he set sail for England, arriving at Dover in June 1617.

The journal ends here, but Mr. Foster with much patience and skill has put together what can be ascertained about the rest of the career of Jourdain. It appears that he was recognised as an authority on Eastern affairs and consulted as such by the Company. In November 1617 he accepted a fresh offer of service for five years, and in February 1618 he sailed with Sir Thomas Dale, with the rank of captain and "principall agent, to give direccions to whatt places the shipps shall be employed, and soe to comand and direct as principall agent for marchandizing." But the voyage was disastrous owing to shipwrecks and sickness. On their arrival at Bantam it was found that the English and Dutch were at war. Dissensions also arose among the English themselves, and it was resolved to abandon the factory at least for a time. Jourdain sailed away north to rearrange some of the broken-down factories, but off Patani, on the east of the Malayan peninsula, he was intercepted by a Dutch squadron. Although much inferior in force he decided to fight, but after two and a half hours' brave resistance he had to surrender. While standing on the deck under the white flag he was treacherously and fatally wounded by a musket shot from one of the Dutch ships. Mr. Foster pronounces a just eulogy of him. "His journal is his monument; and in its candid pages we may easily discern the sterling nature of the man. Fearlessness and energy were perhaps his most striking characteristics; while behind them lay a shrewd judgment and a cool resourcefulness in moments of danger that won him alike the confidence of his superiors and the respect and affection of his subordinates." Well was it for England that at the dawn of her glory as a commercial power, when there sat on the throne a miserable coward who shivered at the sight of a drawn sword, she had in her service men like the Middletons, Saris, Best, and Jourdain; men who feared "neither Don nor Devil," and who on the other side of the world were rough but worthy representatives of her genius and her might.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE INTERNATIONAL CONGRESS FOR THE STUDY OF THE POLAR REGIONS, BRUSSELS, 1906.

At the International Congress for the Expansion of the World's Commerce held at Mons in September 1905 a representative meeting of polar explorers unanimously passed a resolution in favour of the foundation of an International Association for the Study of the Polar Regions, and recommended that the Belgian Government should take the initiative in this respect. This resolution was signed by the following: Duke of the Abruzzi, Duke of Orleans, Messrs. H. Arctowski, Bridgman, W. S. Bruce, Charcot, Cook, de Gerlache, Fiala, Greely, Lecointe, Mossman, Nordenskjöld, Racovitza, Scott, Shackleton, Sverdrup, and others. In consequence the first International Polar Congress met at Brussels from the 7th to 11th September this year. Monsieur Beernaert, Belgian Minister of State, who was President of the Committee of Organisation, was elected President of the Congress.

The following countries were officially represented: Argentine Republic, Chili, Congo Free State, Denmark (Admiral Wandel), France (M. Bigourdan of the Paris Observatory), Germany (Dr. von Drygalski of the German Antarctic Expedition), Holland (le Chevalier Speelman), Italy (M. Guido Cora), Portugal, Roumania, Russia (M. Rykatchew, Director of the St. Petersburg Observatory), Spain, Sweden (Dr. O. Nordenskjöld of the Swedish Antarctic Expedition), United States (Mr. H. Bridgman of the Peary Auxiliary Expedition, 1894). Austro-Hungary, Great Britain, and Norway sent no official delegates, and this surprising abstention was much commented on. In spite of this fact, when the representatives of the above states were elected Vice-Presidents, the Congress called upon Dr. Kövesligethy, Secretary of the International Seismological Association, and Mr. R. N. Rudmose Brown

of the Scottish National Antarctic Expedition to respectively represent Austro-Hungary and Great Britain in the same capacity.

Among others present at the Congress in addition to those noted above were: M. Charcot of the French Antarctic Expedition; Lieutenant Bergendahl of the *Antarctic* relief expedition in the *Frithjof* and the Duke of Orleans' polar expedition; M. Angot of the French meteorological service; MM. Arctowski, Dobrowolski, de Gerlache de Gomery, and Lecointe, of the Belgian Antarctic Expedition; Captain Duse of the Swedish Antarctic Expedition; Dr. Hugh Robert Mill; Mr. R. C. Mossman of the Scottish National Antarctic Expedition; Prince Roland Bonaparte; M. Paul Reclus of the Université Nouvelle; and Lieutenant Maveroff of the Argentine Antarctic Expedition (1904). Mr. W. S. Bruce was not present owing to his absence in Spitzbergen with the Prince of Monaco. The *Discovery* was the only important expedition of recent years that was not represented. The meetings, which were held in the Palais des Academies, opened on the morning of September 7 with an address by the President (M. Beernaert), which was followed by speeches by each of the Vice-Presidents.

In the afternoon the Congress discussed the question of systematising scientific research in polar regions, and M. Lecointe's motion was unanimously passed: That the Congress considers it advisable to elaborate a scheme for methodical exploration of polar regions. Dr. Nordenskjöld proposed that a committee should be nominated to formulate the constitution of an International Polar Association, and the Congress decided that Dr. Nordenskjöld himself should be entrusted with the selection of this committee, which finally included all polar explorers present and several other representative men of science. The full list as passed by the Congress was as follows: Messrs. Arctowski, Brown, Bergendahl, Bridgman, Charcot, von Drygalski, de Gerlache, Duse, Lecointe, Maveroff, Mossman, Nordenskjöld, Rabot, Speelman, Tomatcheff, Wandel, van Asbeck, Turquet, Dobrowolski, and Messrs. Beernaert, van Overbergh, de Mot, Cora, Rykatchew, Mill, Sobral, Bigourdan, and Bertin—nineteen polar explorers and nine other members.

M. Lecointe raised the question of government aid to polar expeditions, and whether the time was now opportune for invoking the interest of various governments in these schemes. Admiral Wandel (Denmark) spoke of the interest his country had always taken in polar work, and assured the Congress that that interest would be maintained in the future. Arising out of this M. Rabot (France) proposed a resolution expressing the admiration of the Congress for the important geographical and geological work carried out in Greenland under the patronage of the Danish Government. This was warmly supported by Dr. von Drygalski (Germany), and M. Cora (Italy) proposed to add an expression of congratulation to the Danish Government for the establishment and maintenance of the new Biological Laboratory at Disco. The resolution was unanimously carried.

Passing to a discussion of the routes and work of the next polar expeditions, M. Arctowski advocated a preliminary expedition to

antarctic regions. This expedition should precede the next great international campaign, and its work should be largely oceanographical and geographical in discovering convenient harbours and suitable spots for land stations and meteorological observatories. He spoke of the necessity of establishing many fixed stations around antarctic regions, several on the coasts of Antarctica itself, and as far as possible some in the far interior.

M. Charcot believed that a preliminary expedition was useless, as each expedition did its own preliminary work, and moreover he maintained that a harbour found one year might be quite impracticable the next owing to changes in the disposition of the pack.

M. Rykatchew spoke in favour of fixed stations in polar and subpolar regions, and in view of their cost advocated delay in sending out great expeditions in the meantime.

M. Lecointe considered a preliminary expedition very advisable, as at least six or seven years must elapse before expeditions on a greater and international scale could be got ready.

Mr. R. C. Mossman warmly supported M. Arctowski's scheme, and thought that the present was an opportune time for the expedition, so that the experience acquired by officers and scientific staffs of recent expeditions could be turned to account. The expedition should consist of two ships, one for magnetic and the other for oceanographical work. Winter stations should not be established, as the relief of the parties left at these stations might seriously curtail the work of the expedition. Mr. Mossman advocated a repetition on general lines of the expedition of Sir James Clark Ross, and emphasised the necessity of an early start owing to the short antarctic summer.

On Saturday the Polar Committee met to discuss the constitution of the International Polar Association. A prolonged and animated debate followed in which several proposals were formulated, but no result arrived at until Monday, when the statutes were finally drawn up to the satisfaction of all, and were passed after some discussion by a meeting of the Congress on the day following. The Association desires to establish closer relations in scientific matters between polar explorers, to attempt as far as possible to co-ordinate observations in polar regions, to discuss the results of polar expeditions, to support, when asked, any undertaking the objects of which are the scientific study of polar regions, especially in pointing out what most requires attention; but the Association will not actually direct or patronise any definite expedition. All nations who have taken any part in polar exploration are to send two ordinary and two extraordinary members, to be elected by the government or the learned societies of their country.

The representatives are to be preferably polar explorers, and, when possible, one arctic and the other antarctic: they are to be elected for six years. Corresponding members can also be elected from among men who have written on scientific matters relating to polar regions. It is probable that the Association will hold a meeting every three years.

For the rest of its work the Congress divided into sections. The

section of Astronomy, Geodesy, Hydrography, and Topography, under the presidency of M. G. Bigourdan, passed several resolutions, among which were: That attempts should be made to determine differences in longitude by wireless telegraphy between known points; That, considering that many polar expeditions winter as many as three consecutive years in one place, it would be desirable that nautical almanacs should be published longer in advance than is at present the case; and That it would be of great interest to measure an arc of meridian on the antarctic continent. Other resolutions dealt with the desirability of using more precise methods in surveying in polar regions and the utility of publishing a periodical dealing with all aspects of polar exploration.

The section of Meteorology and Terrestrial Magnetism met under the presidency of M. Angot. A discussion on self-registering instruments was raised, and the want of such instruments which could run for a lengthened period without attention was brought forward. The section passed a resolution expressing its belief in the use of kites for meteorological purposes on future expeditions. Mr. R. C. Mossman submitted a proposal for a bi-polar campaign, on the lines of the International programme carried out in arctic regions in 1882-3. Those stations should be reopened and the magnetic elements redetermined by placing the instruments in their old positions. In addition, no less than twenty-one south polar stations were proposed, as well as co-operation from ships. Reference was made to the important work at present being carried on in the antarctic under Argentine auspices. A resolution was passed in favour of permanent observatories in countries abutting on polar regions, or at least of as many temporary stations of that nature as possible, during the time that expeditions were at work.

The third section related to Geology and Seismology, and elected Prince Roland Bonaparte its president. A decision was arrived at in favour of at least three fixed seismological observatories in polar regions, distributed as far as possible on different sides of the pole. The necessity of precise observations of glaciation, particularly its diminution, was dwelt upon.

The president of the Oceanographical section was Admiral Wandel. M. Bénard expounded his scheme for arctic exploration. He proposes to drift across the polar basin, using two ships, one of which would enter the ice to the north of the New Siberian Islands, and the other at about 120 miles north-east of that point. A detailed budget of the cost of the expedition was submitted: the total was £48,000. M. Arctowski submitted a resolution in favour of the immediate despatch of one or more antarctic expeditions, principally oceanographical, to explore the least-known sections of the antarctic. This was supported by Dr. von Drygalski, who advocated the wintering of the expedition on the ground that much useful work could thereby be accomplished.

The fifth section, Biology, did not meet.

At a final meeting of the Congress on Tuesday, September 11, the resolutions of the various sections were carried without exception.

During the Congress several entertainments were given and

excursions organised for the members. M. de Favereau, Minister of Foreign Affairs, gave a reception on the Friday evening, and the Communal authorities of Brussels gave one at the Hôtel de Ville on the Saturday evening. On Sunday M. Solvay entertained all the members of the Congress to a banquet, while on Monday the Société Royale Belge de Géographie held a special meeting attended by H.R.H. The Prince Albert of Belgium, at which short lectures were given by Le Chevalier Speelman, on the *Wilhelm Barents* Dutch expedition of 1878-84; Mr. H. L. Bridgman, on the present Peary expedition; Dr. von Drygalski, on his expedition in the *Gauss*; Dr. Nordenskjöld, on that of the *Antarctic*; Mr. Rudmose Brown, on the *Scotia* expedition; M. de Gerlache, on the *Belgica* and the Duke of Orleans' expeditions; and M. Charcot, on his expedition in the *Français*. On the Tuesday M. Beernaert invited the members to a gala performance at the Théâtre Royale de la Monnaie. On the Sunday a whole-day excursion to Antwerp was organised, including a reception by the Société Royale de Géographie d'Anvers.

In all about 250 members took part in the meetings of the Congress.

R. N. R. B.

THE YORK MEETING OF THE BRITISH ASSOCIATION.

After an interval of twenty-six years the British Association once more met at York during the present summer. It will be recollected that the Association was originally founded at that city in 1831, when there was an attendance of 359, as compared with 1959 at the present meeting. During the intervening period the city was visited in 1846 and again in 1880, as already indicated. The present meeting was favoured with good weather, and was in all respects successful, the local secretaries and committees having worked hard to make it so.

Under the editorship of Dr. Auden, a *Handbook of York and District* was prepared for the use of the members, and, as is only natural considering the local conditions, is largely devoted to the various antiquities of the district. About one hundred pages are, however, given to the geology, botany, zoology, and meteorology of the district, the section on the botany being written by Dr. Smith of Leeds University, who has devoted so much time to the botanical survey of the county. Three maps illustrate the volume, a reproduction of Skaife's Archæological Map of York, a general map of the greater part of the county, and a third for the use of the geological section, illustrating the glacial features of the region.

In his opening address, delivered on August 1, Prof. E. Ray Lankester alluded to the fact that at the Jubilee Meeting in York in 1880 the President, Sir John Lubbock, gave as his address a survey of the progress of science during the fifty years since the foundation of the Association. In his own address Prof. Lankester took a rapid survey of the chief lines of progress since 1880. Much of his time was naturally devoted to

the wonders of radium, and the changes which the last few years have produced in chemical and physical conceptions, and much also to the subjects with which Prof. Lankester's own name is more closely associated. In the closing section of the address, however, which was devoted to a consideration of the advancement of science as measured by the support given to it by public funds, and the respect accorded to scientific work by the British Government and the community at large, there is much that is of direct interest to us as a scientific society, and some sentences may be quoted here. Prof. Lankester said:—

While I have been able, though in a very fragmentary and incomplete way, to indicate the satisfactory and, indeed, the wonderful progress of science since this Association last met in York, so far as the making of new knowledge is concerned, I am sorry to say that there is by no means a corresponding "advancement" of science in that signification of the word which implies the increase of the influence of science on the life of the community, and the increase of the support given to it, and of the desire to aid in its progress, to discover and then to encourage and reward those who are specially fitted to increase scientific knowledge, and to bring it to bear so as to promote the welfare of the community. . . . It is, unfortunately, true that the successive political administrators of the affairs of this country, as well as the permanent officials, are altogether unaware to-day, as they were twenty years ago, of the vital importance of that knowledge which we call science, and of the urgent need for making use of it in a variety of public affairs. Whole departments of Government in which scientific knowledge is the one thing needful are carried on by ministers, permanent secretaries, assistant secretaries, and clerks who are wholly ignorant of science, and, naturally enough, dislike it, since it cannot be used by them, and is in many instances the condemnation of their official employment. . . . I think the present occasion is one on which attention should be drawn in general terms to the fact that science is not gaining "advancement" in public and official consideration and support. The reason is, I think, to be found in the defective education, both at school and university, of our governing class, as well as in a racial dislike among all classes to the establishment and support by public funds of posts which the average man may not expect to succeed by popular clamour or class privilege in gaining for himself—posts which must be held by men of special training and mental gifts. Whatever the reason for the neglect, the only remedy which we can possibly apply is that of improved education for the upper classes, and the continued effort to spread a knowledge of the results of science and a love for it among all members of the community. If members of the British Association took this matter seriously to heart, they might do a great deal by insisting that their sons, and their daughters too, should have reasonable instruction in science, both at school and college. They could, by their own initiative and example, do a great deal to put an end to the trifling with classical literature and the absorption in athletics which the British parent desires as the education of his children.

Of the evening discourses, one, that on "Volcanoes" by Dr. Tempest Anderson, had a geographical bearing, and was attended by a large audience which showed special interest in the photographs of the late eruption of Vesuvius and its results.

The proceedings in Section E (Geography) were opened on August 2

by the President, Sir George Taubman Goldie, who devoted his address to the progress of geography. After his address the ordinary business of the section was begun. In the following account the papers are grouped according to their subject-matter, and not according to the date of delivery.

Three papers dealt with subjects connected with Great Britain. One of these, by Mr. James Murray, gave an account of the work of the Scottish Loch Survey. We have published here from time to time the detailed papers prepared by the members of the Survey, but the following summary will be found useful in showing the main results obtained along the different lines pursued. It will be seen that the main work of survey is now nearly over:—

Since its institution by Mr. John Murray and Mr. Laurence Pullar in 1902, the bathymetrical survey of more than 500 of the Scottish lochs has been completed. Among these are all the great lakes of the country, and there remain to be sounded only about 100 lochs, of secondary importance.

Geographical Results.—The Scotch lakes, with very few exceptions, are of elongate, narrow form, and none are really great lakes, the largest approaching 24 miles in length. Yet many of the larger lochs exceed 500 feet in depth, and Loch Morar exceeds 1000 feet. Such depths are comparable with those of the deepest lakes in Europe, and as these are for the most part of much greater breadth and superficial area, the Scotch lakes are relatively very deep. The soundings in general confirm the conclusions previously reached by the Scotch geologists as to the origin of the lakes. Most of the great ones and a large number of smaller ones have the U-shaped section which characterises lakes hollowed out by glaciers. The usual deposit in all the lakes, great and small, is a black, peaty mud, the abundant organic matter partly originating in the lakes and partly entering the lakes from the peat-bogs, from which much of the water comes. The mineral constituents vary with the locality, and micaceous and quartz-sands take the place of the black mud in places. There are also yellow, grey, and red clays, the origin of which has not been studied. It is not known whether these are old strata exposed in the beds of the lakes, or modern deposits at present being formed. The water of most of the lakes is brown and peaty.

Biology.—The outstanding facts which have so far appeared are:—(1) The great prominence in the lakes in summer of conspicuous species of Crustacea belonging to the Arctic association of plankton species. (2) The exceeding richness of the phytoplankton, especially in desmids, a fact first brought clearly out by Messrs. W. and G. S. West. (3) The abundance of certain orders of microscopic animals (Rotifera and Tardigrada) at the lake margins. The third fact probably indicates merely the habitual neglect of these orders in lake studies.

Physics.—The physical observations dealt mainly with temperatures and seiches. Serial temperatures at all depths were taken in all the lochs surveyed, and in Loch Ness an extensive series of simultaneous observations at different parts of the lake was made. The chief outcome of these was the detection of a remarkable seiche (the Internal Seiche).

Seiches.—Observations of seiches were made in many lakes by various members of the staff. The first seiche was noticed in Loch Treig, by Dr. Johnston and Mr. Parsons, in 1902. The detailed study of a few lakes has been undertaken by

Professor Chrystal, assisted by Mr. Wedderburn and others. Professor Chrystal has made important contributions to the mathematical theory of seiches, and has besides effected great improvements in the apparatus for observing seiches. The most important of these is the applying of the statoscope to the recording of seiches, by which an exceedingly delicate tracing is obtained.

The Internal Seiche.—Stripped of complexities, the Internal Seiche may be explained as arising thus: In autumn, when the lake has begun to cool, there is a sharp demarcation between an upper, warmer layer of water, and the deeper, colder layer, which only experiences secular changes of temperature. At this limit, which the Germans call the Sprungschicht, a change of several degrees may occur within a few feet. The effect of a long-continued gale, as shown by Sir John Murray, is to cause an inclination of the upper isotherms of the loch, the depth to which they are affected being regulated by the strength and duration of the wind. At the termination of a gale which has sufficed to cause an inclination of the Sprungschicht we have this condition of affairs—the cold layer coming nearer to the surface at one end of the loch, and, conversely, the warmer layer attaining a greater thickness at the opposite end. We thus have two fluids of different densities superposed and the line of separation oblique, not horizontal. The temporary equilibrium maintained by the gale ceases with it, and the two fluids are thus free to oscillate. Owing to the slight difference of density of the two layers, the period may be very long and the amplitude very great. In Loch Ness, when the Sprungschicht was at a depth of about 250 to 300 feet, the period was about three days and the amplitude as much as 150 feet. This enormous oscillation can only be detected by means of observation of temperature.

Two other subjects of British interest were treated of in the form of discussions, and respectively occupied the greater part of a morning. One of these was on "Coast-erosion," and was opened by a paper by Mr. Clement Reid, F.R.S., who specially emphasised the need of approaching the subject with an adequate knowledge of the geological history of the country, in order to appreciate all the factors involved. The official abstract of his paper follows:—

The erosion of our coast must be studied in conjunction with the disposition of the material eroded. When examined in this way we find in England that it has not been a continuous process, varying when short periods are studied, but averaging the same from century to century. Instead of this regular process, the rapid accumulation in certain places teaches us that coast-erosion, as we now see it, began at a definite date, before which conditions were entirely different. If this were not so, the area of the new lands, accumulations of shingle, and of sand-dunes would be much greater. It does not seem practicable to obtain exact measures, but the rates of accumulation of various recent deposits, and of the silting-up of our harbours, suggest that the cliff-erosion only began 3000 or 4000 years ago, or at about the date when our harbours were already in use and Stonehenge was being raised.

In order to understand the nature of the changes that are now going on it is necessary to look back to the Neolithic period to see what the country was then like, otherwise the existing irregularities of our coast-line will be quite unintelligible. It is not needful to go back further, but we must picture the country as it looked when the sea stood 60 feet lower.

A close study of the buried land surfaces, or 'submerged forests,' found in the alluvium of all our estuaries at various levels down to about 50 feet below the

present sea-level shows that oak trees flourished on the lowest of these ancient soils. This shows that the sea then stood so far below its present level that the highest tides could not reach the roots of these trees. These old land surfaces seem all to be of Neolithic date. During this period the seaward end of all our valleys was deepened till the channel reached about 60 feet below its present level. The south and east coasts of England were utterly unlike what we now see. Instead of bold cliffs there was a wide coastal plain, like that which still extends for many miles west of Brighton, separating the rising Downs from the coast. This plain extended out approximately to the existing ten-fathom line.

About 4000 years ago there set in a fairly rapid but intermittent subsidence of the land or rise of the sea. This subsidence flooded a great part of the coastal plain, brought the waves within striking distance of the rising land behind, and submerged the lower part of all our valleys.

The process seems to have been more rapid and jerky than any change which has been recorded of late years, for the deposits in all our big estuaries tell the same tale. We find rapidly deposited marine silt alternating with thin beds of peat or soils with trees. But the vegetation is usually nothing but brushwood or quick-growing trees, and the peat also is of rapid growth. Only at the very bottom of these deposits, far below the present sea-level, are oaks of more than 100 years to be seen.

The rise of the sea-level may have been completed about 3500 years ago. Whatever may be its exact date, the completion of the rise is the starting-point of our present inquiry. Only then commenced the coast-erosion which we now see; only then did our existing shingle-beaches and sand-dunes begin to form.

At first erosion was rapid, for the sea was merely eating into loose talus or into cliffs of little height; and protective banks of shingle and sand take time to accumulate. As the land is cut into, the cliff becomes higher and shingle-beaches and sand-dunes form, all tending to make the width of the strip destroyed annually less and less.

Of the land thus destroyed part is washed into deep water and lost, but much of the coarser material is rolled into shingle-beaches, or forms sand-banks and dunes. These form our best protection against further inroads. If the coast-erosion is stopped, shingle, beach, and sand-bank will themselves wear out and disappear, and valuable lowlands behind may be spoilt by the sea.

Another compensation for the loss on the coast will be found in the great gain of alluvial land in the sheltered estuaries; but against this must be set the rapid silting-up of our harbours, even of those into which no streams flow.

Before we take for granted the desirability of attempting to stop the erosion of our coasts (except near towns) we must strike a balance between loss and gain. If the loss exceeds the gain there will still remain the question, Shall we obtain any sufficient compensation for the enormous cost of any works put up to protect agricultural land?

Some curious problems are suggested by this inquiry. Many may think them of no practical importance, but to the geographer and geologist they are of great interest. If what is said above is correct, and since civilised man has lived in Britain there has been a rapid change of sea-level followed by a long rest—what are the prospects of a similar period of rapid change again setting in? A new rise or fall to the extent of a few feet would have most disastrous effects on all our coasts and harbours, and would also seriously affect our inland drainage until things were adjusted to the new conditions.

The subsequent discussion was taken part in by Professor Kendall, Mr. Whitaker, Mr. E. R. Matthews, and others. Several of the speakers emphasised the need of taking a broad view of the question, and the danger of allowing unco-ordinated protective action to be taken by individuals. Mr. Matthews gave some particulars as regards the Holderness coast which he has been studying. The average erosion, he stated, was 11 feet a year, and 73,780 acres, or 115 square miles, have been lost on this coast since the Roman invasion. The changes at Spurn Head have been enormous; it has been alternately island and mainland. Flamborough and Lowestoft Ness have been rapidly receding; at other points there has been enormous reclamation.

The other discussion was a conjoint one with the Mathematical Section on a "Proposed Re-measurement of Geodetic Arcs in the United Kingdom," and was opened by a paper by Major E. H. Hills, C.M.G., R.E. It will be recollected that in a paper which we published in the January of the present year by Colonel Duncan Johnston, a table was given (p. 23) showing the relative accuracy of the triangulations in various countries, and indicating how far the British Survey is below the average of accuracy of most other countries. It is this defect which it is proposed to remedy. We quote Major Hill's paper in abstract:—

The fundamental triangulation of Great Britain and Ireland was completed fifty years ago. Though excellent work for the time at which it was done, it is now far behind the standard of modern work of its class.

The result of this inferiority is that the British work cannot be co-ordinated with the Continental series for the purpose of geodetic discussion, such as a determination of the figure of the earth. This defect is all the more noticeable in that the necessary observations to connect the two series were actually made at considerable expense. To remedy this defect, which may justly be described as a standing reproach to British science, it is by no means necessary or desirable to reobserve the whole original network of triangulation. What is required is to connect geodetically, by as good a set of triangles as can be selected, the three extreme points of our islands, viz.—(1) Saxavord, the northernmost point of the Shetlands; (2) Valentia, on the west of Ireland; (3) the stations on the coast of Kent trigonometrically connected with France.

Were this work done we should have completed, as far as lies in our power, two very important lines of geodetic triangulation—namely, the meridional arc, through the longitude of Greenwich, and the longitudinal arc, along the parallel of 52° north latitude.

At present, without including Great Britain, these arcs extend from the north-east corner of France to Ain Sefra in Algeria and to Orsk in Russia respectively, amplitudes of 18° and 57°.

With the British work there would be available added amplitudes of 10° and 11½° respectively. Geodetic work is now much more rapid, as well as more accurate, than when the triangulation of England was done. The invention of invar has enormously simplified the difficult operation of base measurement, and the theodolites, for making the angular measurements, can now be obtained more precisely graduated and of a design altogether superior to the older forms. The general result of these improvements is that, while a much higher standard of accuracy can be realised, the rate of progress of such work has been increased in an even higher ratio.

The work should be done by the Ordnance Survey Department, which is, it is believed, quite ready to undertake it; and the powerful influence of the British Association might justifiably be exerted in persuading the Treasury to grant the requisite funds. The total cost would be quite trifling compared with the existing national expenditure upon survey work.

Colonel D. Johnston presided at the discussion, and warmly supported Major Hills' proposals, as did also the other speakers—Prof. Turner, Major Close, and Colonel Hellard. Major Close mentioned as a less ambitious scheme the measurement of the central meridian of England running north from Southampton.

Several papers dealt with Asia. Thus Prof. Ramsay, D.C.L., LL.D., etc., gave an illustrated afternoon lecture entitled "Past and Present in Asia Minor." It is hoped that the members of the Society may have an opportunity during the coming session of hearing Prof. Ramsay on this subject, but meantime we may indicate here the chief points which he successively took up.

I. The geographical situation of Asia Minor is noteworthy as bridging the sea between Asia and Europe, and its importance in world-history arises out of this situation.

II. The conquest by the Turks, 1) Seljuk and 2) Osmanli, meant the reduction of great part of the country from the settled and civilised state to a semi-nomadic stage of society.

III. A distinction is to be noted between the nomads, or Turkmen, and the city Turks (now called Osmanli). This distinction is as old as the first Turkish invasion. The nomads were the real conquerors of the country, and they were practically independent and hardly part of the Turkish state until comparatively recent times. They spread like a flood over the land and submerged it.

IV. In the cities the industries of the Roman Empire survived. Most of these industries gradually and slowly died out, drowned by the flood of nomadic barbarism. Some of them survive to the present day. Some lasted till within the memory of men still living. Some died long ago. The chief cause of their destruction was the difficulty of communication over the country. While the cities at first retained their old standard of civilisation, they were divided from each other by the sea of barbarism and nomadism. In earlier Turkish time trade passed with difficulty from city to city by aid of the large and splendid khans, which the Seljuk Sultans built at intervals along the chief roads. These khans, though often very beautiful as buildings, were not a proof of civilisation, but of the submergence of civilisation. They were fortresses, in which caravans might rest safe from the nomads at night: tiny islets in the sea of nomadism.

V. The land to a great extent passed out of cultivation; irrigation was destroyed in most places; land became stony, destruction of terracing, etc., occurred. No possible cure exists except generations of peasant proprietors. The olive, the tree of civilisation, almost ceased to be cultivated except where the Greeks constituted the main body of the population.

VI. A revival of prosperity has taken place in recent times. The chief cause is the restoration of communication, partly through railways, partly through road-making. From this spring all the other causes, which are superficially more conspicuous. Industries have revived, as is exemplified by the enormous growth of the carpet trade; the spread of an industrial population along the railways

that lead inland from Smyrna; the handkerchiefs of Bulladann. Agricultural development is to be seen in the growing of cotton and the collecting of liquorice-root, and the reclamation of waste land around Smyrna by giving allotments to *bona-fide* cultivators.

VII. The Bagdad Railway: Character of the line in Asia Minor; the religious ceremony at the inauguration; opening of the first section; prospects.

Another afternoon lecture was given by Major Molesworth Sykes, who spoke on "A Tour in South-Western Persia, with an Account of the Ancient Cities of Narmáshir."

An abstract of this paper follows:—

The tour was undertaken by the author in connection with a commercial mission which reached Bandar Abbás in the autumn of 1904, and spent the last days of that year at Kermán, the capital of south-east Persia.

The start was made in January 1905, and the first night was spent at an altitude of 7000 feet in intense cold. The second stage was of extraordinary interest, lying through grim, gloomy defiles shut in by beetling cliffs which towered thousands of feet above. The crux of the stage was an extremely steep pass, from the crest of which the travellers enjoyed a superb view across a succession of rugged ranges to the illimitable Lut, the great desert of Persia.

At Khabís, which is situated in *Garmsir*, or Hot Country, the rigours of winter were exchanged for warmth, and the eyes of the travellers were filled with the beauty of the palm and orange groves, for which the centre is famous.

After a short halt the uplands were again entered, and the large party crossed a waterless stretch of thirty-eight miles in safety. Had the weather been bad, it would have gone hard with the weaker members, blizzards in January at high altitudes being extremely dangerous in Persia.

Bam, a considerable town of 13,000 inhabitants, was the next centre of importance. One striking fact is that from Bam to Quetta—a distance of some 700 miles—there is not a single centre of any importance. This fact speaks for itself more eloquently than any description.

From Bam the district of Narmáshir was entered, and its ruined cities were visited. They are referred to as important centres by mediæval travellers, such as Mukaddasi and Hamd Allah, but have never been identified by modern travellers. The most important of the ruins, the erstwhile famous city of Narmáshir, which was once an entrepot for Khorasán merchants trading with Oman, is now absolutely deserted. Crumbling walls and an artificial mound in the interior, on which the Kush-va-Ran fort undoubtedly stood, are all that is left of what was once a city containing perhaps 40,000 or 50,000 inhabitants.

From Narmáshir the travellers made some long marches through a district without supplies to Rudbár, the Reobarles of Marco Polo, whose route was struck. Thence the Halíl Rud was followed up to the district of Jiruft.

Excellent francolin shooting was enjoyed near the site of Komadin, which is another vast ruin covering an area of several square miles, and is the Camadi of Marco Polo.

From Jiruft the Jabal Báriz range was traversed in safety, although the rivers were in flood, and the party marched to Ráin, and thence to Máhún. The beautiful shrine at this latter centre was founded in honour of Shah Namat Ulla with funds supplied from distant India. This saint, who flourished in the fourteenth century, was a contemporary of Tamerlane, who treated him with great distinction. He travelled widely, and Ahmad Shah, of the Bahmanid dynasty of

southern India, was among his disciples. The prophecies of Shah Namat Ulla are still well known in the Middle East. One of them foretold that Christianity would rule in India for a century, and this saying was undoubtedly a cause, if not a main cause, of the Indian Mutiny.

Another Asiatic paper was an account of a "Journey in the Central Himalayas and Adjacent Parts of Tibet," by Mr. T. G. Longstaff, M.A., M.B. The following indicates the route taken by the party :—

The journey was undertaken during the summer May to October) of 1905. The primary object was mountaineering, and the writer was accompanied by an Italian alpine guide and a porter. The distance travelled was about a thousand miles. Kumaon was first visited, and the eastern glaciers of the Nanda Devi group were explored, heights of over 20,000 feet being attained by the party. The extreme north-west corner of Nepal was next visited in order to examine the glaciers to the north of Nampa. By the kindness of the Indian Government the party were allowed to accompany Mr. C. A. Sherring on his political mission to Western Tibet.

Entering this country by the Lipu Lekh Pass (16,780 feet), Purang (Taklakot) was reached on July 15. Leaving the mission here, the writer spent a week on Gurla Mandhata (25,350 feet), reaching heights of about 23,000 feet. The glaciers and valleys of this group do not seem to have been previously visited. Rejoining the mission at Mansarowar Lake, the whole party passed along the neck of land separating that lake from Rakas Tal, and examined the channel, seen by the brothers Strachey, between the two lakes.

Passing close to the sources of the Satlej, the two parties separated at Missar. Mr. Sherring proceeding to Gartok, and the writer making his way to Gyanema, and thence to Shipchilam. On August 28 the Chor Hoti Pass (18,500 feet) was crossed into Garhwal. Following the course of the Dauli River, Gwaldam was reached in September, and at the beginning of October a reconnaissance was made up the Kuramtoli glacier at the foot of Trisul.

It is hoped that members will have an opportunity of hearing Dr. Longstaff during the coming session.

Mr. Stanley Gardiner presented to the Section a general report on his recent investigations in the Indian Ocean, and also read a paper on the details of his work in the Chagos Archipelago. As we followed here step by step the progress of the expedition, the Report need not detain us, but the paper on the Chagos group gives an admirable summary of the conclusions reached by the members of the expedition, and may be quoted in abstract here.

The Chagos Archipelago is perhaps the least known coral region in the world. Situated nearly 5° to the south of the Maldives, from which it is separated by over 2000 fathoms of water, its bank within the 1000-fathom line covers about 21,000 square miles. In this area arises a series of shallower banks, separated by 300 to 800 fathoms of water, varying from approximately flat submerged shoals at 20 fathoms or less to large, more or less complete, ring-shaped surface reefs, or atolls. The whole is probably part of a large land mass which connected Madagascar to Southern India up to the commencement of the Tertiary period (Eocene). The submerged banks are believed to be gradually assuming the atoll-shape by coral and algal (nullipore) growth on their edges. If the existing atolls have been

formed from such shoals—and this is probably the case—they show in a marked manner an accompanying increase in depth in their centres by solution, tidal erosion, etc., some lagoons being 40 to 50 fathoms deep.

Land on the encircling reefs of atolls may be formed either by the piling-up of coral masses from the reef-flats or by some change of level of the reefs in respect to the sea. Both methods are found in the Chagos, but there is evidence in every atoll of some apparent upheaval. This alteration of level would appear to be universal throughout the Indo-Pacific coral-reef regions (lat. 30° N. to lat. 25° S.), the required amount varying from 5 to 35 feet. Since the phenomenon is so widespread, and there is evidence of many local upheavals throughout this zone, it would seem to be due to some withdrawal of water from the equator rather than to any change in level of the ocean floor. The causes of this are probably to be found partially in the attraction of continental masses on the water, but mainly in the piling-up of ice in the south polar regions.

The lagoons of the atolls are generally increasing in size at the expense of the land, that in Diego Garcia being fringed for a great part of its circumference by low cliffs. Remains of land are found at the edges of the Salomon Reefs towards the lagoon, where the bottom drops almost perpendicularly from 1 to 4 or 5 fathoms. This further clearly indicates an enlargement of the basin at the expense of the encircling reef-flats. Boring and land-triturating organisms are almost as conspicuous destructive agents as in the Maldives, and the tides are of great importance in removing fine sand and washings from the lagoons. Practically no coral masses are swept off the encircling reefs into the lagoons, growing animals and plants alone tending to fill them up.

The reefs throughout the Chagos are extending seawards by means of corals and nullipores, the latter acting mainly as consolidating agents, but practically forming the whole edge below 5 fathoms. The foundations for these—true reef-building corals only live down to 35 fathoms, and nullipores down to 60 fathoms—are formed by masses from the shallower parts of the reef above swept outwards by under currents. The reefs, in fact, are everywhere spreading outwards on the piled-up remains of their own organisms.

The reef animals are as abundant as in the Maldives or Seychelles, but their variety appears to be considerably less. In fact the Chagos is thoroughly oceanic in its reef fauna, showing no trace of any former connection with continental slopes. The land animals and plants are such as might be expected on any isolated oceanic islands, but the vegetation is further restricted owing to the islands being purely of limestone formation.

Various papers dealt with African subjects. Thus Mr. John Parkinson spoke on "The Structure of the Southern Nigeria" from observations made during a mineral survey of the region under the auspices of the Imperial Institute, emphasising the provisional character of his remarks in view of the fact that he had not visited much of the colony. His chief conclusions are as follows:—

The boundaries of the crystalline rocks are of fundamental importance in understanding the geology of the region.

The southern boundary of these rocks, which are by far the oldest member of the rather limited series found in the colony, forms a rude semiellipse, indented on the east by the complex of the Oban Hills, and crossing the Niger in lat. 7° 19′ N. (Gürich). As far as Southern Nigeria is concerned outliers of the sedimentary series do not occur, or have not yet been found. The researches of Esch and Solger

have proved the occurrence of Cretaceous rocks in the Kamerun, and during the past three years these have been traced westward, by the Mineral Survey of Southern Nigeria, round the base of the Oban Hills, up the Cross River to Abakalliki, the most northerly point yet reached in the eastern province. The appearance of the country as seen from Abakalliki suggests that the Cretaceous strata extend northward for another 30 miles. Their westward extension, whether of surface or sub-surface, remains to be definitely fixed, though they probably extend from Afikpo to within 50 miles of the Niger as the dominant formation. Westward from Asaba to Benin City and Ifon, and through the Ijebu country to Abeokuta, the country is an undulating plain, consisting entirely of rocks later than Cretaceous in age. From geological considerations the author concludes that we have here beds representing, not a continuous sequence, but a series of episodes in the Tertiary history of the country.

The geography is, of course, directly related to the lithology and the geological history of the rocks. Four distinct types of country have to be studied; the first is that built up of complexes of crystalline rock; the second is that formed by the Cretaceous strata; the third is composed of Tertiary beds, the most conspicuous of which are the red sandy clays typical of Ijebu and Benin; while the fourth, still in process of formation, consists of the delta and mangrove swamps. Each of these exhibits physical features peculiar to itself, and not shared by any other member of the series.

Brief reference was made to the salient characteristics of each group. In the Oban Hills we find an unorientated group of peaks, attaining an elevation of rather over 3000 feet, characterised by steep slopes and drained by a rejuvenated river system. The best example known to the author of the second or Cretaceous type of scenery is that between Afikpo and Abakalliki, where the effects of erosion on a group of strata of varying hardness, folded by a north and south movement, are admirably seen. The country here is of the orchard type, and most assiduously cultivated, but on the northern and southern slopes of the Oban Hills the Cretaceous rocks are covered with dense bush, which masks the physical features. The country formed by the softer red loams and sands characteristic of parts of the central and western provinces is exceedingly monotonous, being covered with heavy bush and drained by a very mature river system. The watercourses are greatly encumbered by sandbanks. Near Asaba we find low hills, but for the most part, *e.g.* between Ifon and Sapele, the surface is gently undulating. The delta region is probably in reality not so flat as it appears from the sea, for inliers of the red sands of Benin, forming low hills and surrounded by mangrove swamps, are not uncommon.

In an afternoon lecture, Mr. Trevor-Battye showed a striking series of views, and read a paper on "The Zambesi beyond the Victoria Falls," the results of a journey made at the close of the visit of the British Association to South Africa last year. The paper, which was illustrated not only by views but also a variety of native exhibits, dwelt both with the people and the scenery of the district traversed. The journey was made in dug-out canoes worked by natives, and in this way Mr. Trevor-Battye ascended the river for more than 100 miles above the Falls. The most interesting point as regards the scenery is that wherever the basaltic rock crops out near the river, rapids occur, with the adjacent banks and islands covered by a tangle of forest growth. Three such stretches of rapids were found during the journey to Sesheke, and

between them and their attendant forest areas lie immense plains, largely under water in the wet season, and swept by fire in the dry season.

Another afternoon lecture, which was very well attended, dealt with the visit of the British Association to South Africa last year, and was delivered by Mr. Yule Oldham.

Two papers dealt with American topics. Prof. L. W. Lyde discussed the "Climate of the Wheat Area of Central Canada," showing how the climatic conditions favour the growth of the crop, especially along a line through Brandon and Battleford. He gave a high estimate of the probable output of wheat from this area in the immediate future, but stated his opinion that wheat-growing here was eminently the work of the small farmer. Prof. Lyde gave the following brief summary of the climatic conditions prevailing at the different seasons:—

In this area we have a typically continental climate modified by latitude and lakes: a long summer day, slow rotation of earth, chinook winds. The operation of these factors is seen in the character of the forest.

Spring is sudden and short, being limited, as far as wheat-cultivation is concerned, to the four weeks in *April*, when there is an average daily maximum of (+ and −) 50° F., the east being 5° colder than the west, where snow is not "packed," and is therefore easily licked up by the chinooks.

With unit of population, *i.e.* one family of five persons (at least two of them males), the maximum of plough, harrow, and drill that can be "risked" is 80 *acres in the four weeks.*

Summer is the rainy season, beginning with mid-May rains and ceasing with mid-August dry spell. Temperature rises steadily May-June, with rain: Winnipeg district has more than half, Qu'Appelle and Prince Albert districts have more than three-quarters, of the total rainfall in the three "growing" months (May, June, July). Mean temperature (June-August) on Brandon-Battleford curve is 62·5°, which is equal to that of best English wheat land. The duration of sunlight varies from about 15½ hours per day at midsummer in Winnipeg district (averaging one hour per day more than Chicago district from June 15 to July 1) to over 17 hours at Prince Albert, with very high percentage of bright sunshine (result, a fine-coloured grain), especially along Brandon-Battleford curve.

Duration of night.—There is a short night, *i.e.* a short time for radiation, but a comparatively long "cool" spell, which is as favourable to wheat as it is unfavourable to maize (and mosquitoes).

Autumn is a dry season: (*a*) August, harvest. One family can bind and stook 70-80 acres in one week (if there is a third male, one family can cart this in a second week to central stack, and have the equivalent of 1200 bushels of grain ready for thresher by the end of August); (*b*) September, average temperature drops 10° F., and loses 70 hours of bright sun; October drops 10° F. more. Therefore it is desirable to plough at once. Loss of "fall" plough means loss of early seeding the following year—that is, loss of yield per acre, loss of weight per bushel, loss of market by water transport.

Winter.—Length and intensity of cold do not affect the north limit of wheat in summer, but guarantee cleansing of ploughed land, and leave no excuse for grain not being also clean.

Another paper, by Major Beacom, gave an interesting account of the vast irrigation projects undertaken by the United States Government during the last few years. The following is an abstract of this paper:—

In the United States west of the 100th meridian of longitude, there are vast areas of unproductive, arid land. 10,000,000 acres have already been reclaimed and made very valuable by irrigation, and it is estimated that 50,000,000 acres more (an area equal to that under irrigation in India and Egypt combined) can be reclaimed.

As the result of experience, the conclusion was reached in America that the greater irrigation projects could be carried out by the Government better than by individuals, and in 1902 the Reclamation Act was passed, putting the whole matter under Government control. Funds were provided by setting aside the moneys received from the sale of public lands in the arid states. This fund now amounts to £6,400,000 and it is increasing at the rate of £850,000 yearly.

Under the provisions of the Reclamation Act, Government engineers survey the arid lands, prepare plans for the irrigation works, and construct or superintend the construction of them.

The Government is reimbursed for this outlay by each settler on these irrigated lands paying to the Treasury, in ten or less annual instalments, the charges that have been apportioned against his tract. In this way money employed in the construction of works becomes available in a few years for the construction of other works.

Twenty-four projects, as shown below, have been approved, and on thirteen of them work has actually begun :—

Location of Project.	Name of Project.	Amount allotted and to be allotted this Year.	Estimated Cost of completed Project.	Acres to be Reclaimed.
Arizona	*Salt River	£791,123	£791,123	175,000
Nebraska-Wyoming	*North Platte	684,270	684,270	100,000
Montana	*Huntley	184,937	—	30,000
„ and M.D.	*Lower Yellowstone	390,423	390,423	66,000
„	Milk River	205,486	—	100,000
Oregon	*Klamath	410,973	821,946	240,000
„	Umtilla	205,486	205,486	20,000
California-Arizona	*Yuma	616,459	616,459	85,000
Nevada	*Truckee-Carson	616,459	1,849,378	400,000
Idaho	*Minidoka	267,132	—	—
„	Payette-Boise	267,132	1,849,378	372,000
Colorado	*Uncompahgre	513,716	513,716	100,000
Washington	Okanogan	102,743	102,743	10,000
„	Tieton	205,486	—	24,000
„	Sunnyside	154,114	—	40,000
Wyoming	*Shoshone	462,344	462,344	75,000
South Dakota	*Belle Fourche	431,521	554,813	85,000
North Dakota	Pumping Projects	205,486	—	80,000
Utah	Strawberry Valley	256,658	—	50,000
New Mexico	*Hondo	49,316	49,316	10,000
„	Carlsbad	123,292	123,292	15,000
„	Rio Grande	41,057	1,479,503	180,000
Kansas	Garden City	53,426	53,426	—

Note.—Those marked with an asterisk are under construction. The "Lower Yellowstone" is treated as two projects.

After considering the engineering and legal features of some of these projects, and touching upon the dispute between Canada and the United States over water rights, the author enlarged upon the Colorado River as the American Nile, and noted the changes in the Colorado desert due to irrigation. The *rôle* of the Government as an irrigation farmer was considered, and mention made of the investigations and experiments undertaken by it, and of the aid supplied to inexperienced settlers. The subject of plant immigration and plant breeding was touched upon, and a summary given of the changes in life forms that have taken place during the last thirty years in the western half of the United States.

Australia was represented by a paper by Professor Bottomley, who gave a description of the limestone caves of Western Australia. He stated that there are one hundred of these within an area of 15 square miles, and that alike the road to them and the caves themselves are of great beauty.

Mr. Rudmose Brown read a paper on the geography of the South Orkneys, as studied by the recent Scottish Antarctic Expedition, in which he stated that the movement of the ice in the vicinity of these islands afforded in his opinion evidence against the theory of the continuity of Graham's Land.

A paper on geographical photography was read by Mr. John Thomson, and a very suggestive one on "The Study of Social Geography" by Professor G. W. Hoke of Ohio State Normal College. The following theses were discussed in this contribution :—

1. Geography is the science of distribution.
2. Geographic science is best served by a study of the *causes* rather than by a study of the *effects* of distribution.
3. Geographic factors need not be *facts* of distribution.
4. The factors of social distribution are *historic* and *psychic*, as well as environmental.
5. The student of geography must have a clear-cut notion of the limitations of the field, and to prevent hopeless confusion it is essential that he keep constantly in mind the relation of the special subject of investigation to the field of geography as a whole.

It is announced that action has been taken by the Council in accordance with the recommendations made in the following resolutions from Section A, which are of interest to geographers :—

(1) The Committee being of opinion that the completion of the geodetic arc from the south to the north of Africa is of the utmost scientific importance, and that the establishment of a Topographical Survey is of an importance that is at once scientific and economic, respectfully request the Council to make representations in such form as they think fit to urge upon the British South Africa Company the desirability of taking advantage of the present favourable opportunity for joining up the triangulation north and south of the Zambesi, and also to urge upon the Governments of the South African Colonies the immense practical and economic importance of commencing the topographical survey.

(2) The Committee desire to draw attention to the importance of a Magnetic Survey of South Africa, and respectfully request the Council of the Association to approach the Cape Government with a view to urging upon them the great advantages which would accrue to science and to South Africa if the Government

would further support and assist the survey which has already been partly made by Professor Beattie and Professor Thomson, and for the continuation of which a Special Committee of the Association is being appointed to co-operate with these gentlemen.

A grant of £300 has been made from the Special South Africa Fund of the Council to Sir David Gill, for the purpose of completing the connection between the Rhodesian and Transvaal triangulations along the thirtieth meridian of East longitude.

The grants of money appropriated by the General Committee to Section E are two in number, £50 being given for the study of the oscillations of the Land Level in the Mediterranean Basin, and £10 for the study of rainfall, and lake and river discharge.

At the meeting of the General Committee on August 3, the date of the opening meeting at Leicester next year was fixed for July 30. Sir David Gill, K.C.B., F.R.S., is to be the president. The meeting in 1908 will be in Dublin, and that of 1909 at Winnipeg, Canada.

THE LADO ENCLAVE AND ITS COMMERCIAL POSSIBILITIES.

By J. Penman Browne.

I propose here to give a short descriptive sketch of the Lado Enclave and its commercial possibilities, based upon journeys made by myself in this region. We may begin a survey of the stations of the Enclave with Kiro, which is the most northerly post occupied by the Belgians, and lies on the confines of the Enclave. The post is built on the west bank of the Nile, and is gradually being washed away. The Nile on nearing Kiro attains great velocity, and strikes the banks with such force that, bit by bit, the bank is being undermined and carried away. In short, before very long the post will cease to exist unless something is done to stop the river from carrying away the bank. Piling has been suggested in order to break the force of the Nile, but this is impracticable, owing to the greasy rock bed formation. A brick retaining wall could be built, using the rock bed as a foundation.

With the White Nile flowing past in front, and the swamps which surround it, Kiro and its environs are anything but healthy, while the mosquitos are in countless thousands, and tend to make one's life a misery. What ought to be done in Kiro would be to hew down the huge trees that are growing there, as I believe that were the trees cut down the shelter of the mosquitos would be to a great extent cut down also. I have noticed that wherever you get many trees growing you generally get a great many mosquitos.

Kiro is occupied by two Belgian officers, with from 50 to 100 soldiers. An hour or two's march inland, at a place called Fariala (named after the reigning chief), one gets beyond the deadly influence of the fever-breeding swamps of Kiro. Fariala lies among some little

hills, and is eminently suitable either as a station or a sanatorium. Another advantage, apart from its healthfulness, is that a political officer there would get into direct touch with his people, there being many chiefs and their followers in and around Fariala, whereas there are very few around Kiro. A little further on we come to the old Belgian station of La Loret. I cannot imagine why the Belgians vacated this place. Along the route the butter-tree (Bassia) grows abundantly. Here and there, growing out of the rocks, as it seemed, were many of the weird-looking Euphorbias (*Euphorbia Candelabrum* being the most common). Acacias are also very common, not only on this route, but all over the Enclave. The natives grow millet, sesame, ground nuts (*Arachis*), sweet potatoes (*Batatas edulis*), and a few bananas of the larger species, also a little sorghum. Tobacco is also grown (*Nicotiana rustica*), though not extensively at present, the amount being only sufficient for the local demand. Hemp is also grown and smoked. The species of hemp that is grown in the Lado Enclave is, I think, *Cannabis indica*, which is known in Egypt by the name of Hashish. Among West African tribes this plant is also known under the name of Diamba, and is used for intoxicating purposes under the names of "Maconic" and "Makiah."

We are now *en route* for Tafari, on the north-western confines of the Enclave. This used to be an old Belgian post, and was only evacuated about the latter end of 1903. It is built on the banks of the river Tafari, and is just on the border of the Bahr el Ghazal. The Tafari is an affluent of the river Gel. Marching from Kiro on the White Nile to Tafari on the borders of the Bahr el Ghazal, the journey with porters only occupies some five or six days. In another six days we are in the rich southernmost provinces of the Bahr el Ghazal.

Returning to Kiro, we may take the steamer to Lado, which can be reached in about seven hours. The first thing that struck me on seeing Lado for the first time was the scrupulous cleanliness of the place, and another the beautiful brick buildings for the officials, and the neat arrangements of laying out the houses for soldiers' occupancy. A neat and well-constructed guard-house, prison, bureau, magazines, etc., all planned and built by Commandant Casito and his efficient staff, go to make the township of Lado. Lado is, after Yei, the largest post in the Enclave, and is fortified, having a garrison of 550 soldiers, along with a staff of twelve white officers. There are not many natives in the immediate vicinity of Lado. This post was one of Emin Pasha's old Equatorial stations. Leaving Lado by steamer, we journey to Rejaf, the next occupied station. Three hours' steaming takes us past Gondokoro, the frontier post of the Uganda Protectorate and the Sudan. The large steamer from Khartum gets as far up the Nile as Gondokoro, but no further, owing to the shallows of the river beyond this place. Another three and a half hours brings us to Rejaf.

Rejaf lies upon the west side of the Nile bank, close to the foot of Mount Rejaf. It is interesting to mention in passing that right on top of this mountain Emin Pasha has his name initials chiselled upon a rock. Rejaf is very warm, and notwithstanding that it lies at a higher

altitude than Lado is more unhealthy, malarial fever being very prevalent. There is a garrison of somewhere about 100 soldiers. Rejaf is the starting-point from the Nile for caravans going into the interior. It is also to be the starting-point of a locomobile service of transport, of which something will be said later.

Meantime we may follow the proposed route of the locomobiles. The first place we arrive at is Songola. This place is only a rest-house, two hours from Rejaf, and gets its name from the fact that there are innumerable antelopes there, Songola being the native name for antelope. Going on for another three and a half hours, we arrive in Dikala: which gets its name in the same way, only Dikala is the native interpretation of the word giraffe, giraffes being numerous in the bush around this part. Another two hours, and we arrive in Bongo. The bush at this place literally swarms with elephants. The native name for elephant is Bongo, and so the natives have named the rest-house appropriately. On nearing Bongo, one is struck by the numerous Euphorbiaceæ, and Mimosæ; also the innumerable baboons that jump from rock to rock on the adjoining hills and bark at travellers plodding along in the burning heat of the sun. After leaving Bongo, we have a longish march of some four and a half hours in order to reach the rest-house at the river Papwa. Hitherto, from Rejaf right to Papwa, we had only been crossing sandy khors, and water in many cases could only be had by digging—it was in the dry season that I made my journeys. Now we had reached the Papwa river. River, we were told it was, but, on reaching it, found it nothing but a broad sandy khor, with but very little water, although when it rained the natives informed me that in an hour's time this stream was converted into a raging torrent. Leaving Papwa, we now make for Maliba Mokru or Colonne Mobile, as it was once called. This place was once an occupied station of the Belgians, but has now been evacuated. Maliba Mokru means big stream in the native vernacular, but here, as before, there was nothing but a broad sandy khor, containing only a very little water. It takes one two hours to get from Papwa to this place. We shall now go on to Mafe, which is only another two hours distant. On nearing Mafe we have to go through a bamboo forest, round a hill, and over another entirely covered with bamboos, and then we are in Mafe. Passing through another bamboo forest, we find ourselves making for Wandi, lying at the foot of some mountains of the same name. We got in here exactly two and a half hours after leaving Mafe. There is a very strong and substantial bridge built over the khor here, built, if I remember rightly, under the supervision of the Chef de Poste of Loka, an Italian.

Lions and leopards are very numerous around Wandi. I saw leopards in the trees frequently, and heard often the roar of the lions at night; in fact, one lion came into our zeriba and tried to steal away one of our cows. Getting up early next morning, we set out for Loka, or Gumbiri, as it is sometimes named, and arrived there in two and three-quarter hours. Loka is the first State-occupied station since leaving Rejaf. It is the prettiest station in the whole of the Enclave, and at the same time, the most healthy. Having an altitude of 3000 feet

above sea-level, this place is used as a sanatorium for the officers of the Enclave. It is eminently suitable for such a purpose. From here a road branches off to Kajo Kajo, a small post on the plateau on top of the Kuku mountains. Loka has long avenues of banana and pawpaw trees, and here a pleasant walk can be had, even during the heat of the day. Loka is supposed to be the terminus of the locomobiles; as yet only one of them has managed to reach it, and it took some months to do that, although the journey on foot only occupies a few days.

We will now leave Loka and make for the headquarters of the Enclave, Yei by name. Yei is on the west bank of a river of that name, and is a heavily fortified post, with a garrison strength of somewhere about 700 soldiers and about a score of officers. From here roads branch off towards Wandi, Rafai, and Bandukia to the north-west; and to Mount Watti and Wadelai in the south. Leaving Yei, we proceed once more west, and pass the small post of Aissa, and arrive in Aba. Aba is the last post within the confines of the Enclave going west. Beyond that we come to the Welle district of the Congo Free State, and with it in this present article, we shall have nothing to do. Let me now take you back to Yei, and from there we shall take the route for Mount Watti and Wadelai, lying towards the south. Passing through the Kakwa tribe's territory, the Kaliko's territory, and into the Lugori country, we find ourselves at Mount Watti, and in the midst of a hostile tribe, the Lugori. They are a very powerful tribe, and have enormous herds of cattle, sheep, and goats, a sure sign of their wealth. On entering the Lugori country one sees a great expanse of broad rolling prairie land, the grass all cropped short like some of our grazing lands at home here. Clear, cool, running streams flowing through broad, cultivated areas of fertile land—for the Lugori are an agricultural as well as a pastoral race of people—help to remind one of our own rural districts of home. Their homesteads and houses are built of stone puddled with clay and thatched with grass, and are quite distinct from those previously seen in the other parts of the Enclave. The people themselves are also quite distinct. Tall, and without a vestige of clothing, they present a striking appearance. At the present time they will allow no one to enter their country to explore it.

Let us now leave Mount Watti and get to Wadelai. The journey from Yei to Wadelai occupies ubout ten days; and we are now in Wadelai, and on the White Nile again. This post stands upon a small hill, and has the distinction of being one of Emin Pasha's old stations. We will now proceed to Mahagi, the southernmost post of the Enclave. Three days' marching takes us there. Mahagi is a small fort on Lake Albert Nyanza, and is within the confines of the Enclave; beyond that is the Upper Ituri district of the Congo Free State. There are only some 50 soldiers in Mahagi, so it is really a very small place. I must now take you back to Wadelai, in order to visit those posts on the Nile that we have missed. Six days' march north of Wadelai takes us to Dufile. Dufile is on the Nile, and just opposite our Uganda post of Nimule. There are about 300 soldiers, and some five or six white officers stationed there. There is only one more occupied post in the Lado Enclave, and

then we will have gone the round of occupied stations. It is the small insignificant post of Kaya, two days north of Dufile, on the Nile. This place corresponds to Emin Pasha's Kiri, is built at the junction of the river Kaya, with the waters of the Nile. Below this place we have Bedden, and one day more and we are back in Rejaf again, having gone the round of the whole of the occupied stations of the Lado Enclave.

The Tribes of the Enclave.

The tribe of the Enclave are numerous. The Bari inhabit that part in close proximity to the White Nile or Bahr el Jebel. They have large herds of cattle, sheep, and goats, and their chief industries are the making of pottery and iron-working. Between Kiro and Tafari, and also in and around Loka, we have the Fajelu; in and beyond Tafari, the Moru; south of the Moru tribe we have the Yambara; to the south-west of the Yambara the Abukaya, Mundu, and Makraka; while a little further to the south-east we find the Kaliko; and still a little further east than the Kaliko, the Kakwa, Kuku, and Madi. The two last-mentioned have their homes near Kajo-Kajo and Dufile respectively. South of Dufile we have the Luru, and to the west of the Luru, the Keguru and the hostile Lugori.

The Fajelu and Yambara are an agricultural race of people, as are also the Kakwa and Kaliko. The others, save the Makraka, are pastoral, as well as agricultural races. Nowhere else in Central Africa have I seen such large herds of cattle, sheep, and goats, as those I saw belonging to some of the above tribes, and nowhere else there have I seen such large tracts of cultivated land. On all sides can be seen great waving fields of durra, eleusine, millet, and beans, with large areas of ground nuts, etc.: all go to form a pleasing picture to the eye and also to prove beyond doubt the richness of the soil of the Enclave, where so large and varied crops can be raised with only the merest surface scratching.

Nearly every small village has its cattle enclosure. The natives count their riches by the number of wives and cattle they possess, and to ask a chief how many cattle he has got, is only another way of asking him how rich he is.

Among the Fajelu and Yambara a chief may have from five to ten wives. Marriage is by purchase, and polygamy is general. The ornaments that are worn by the women are of iron, and consist of anklets, armlets, and brass finger rings, and strings of blue beads. The men's ornaments consist of ivory armlets and brass rings.

The majority of the men are nude, while the dress of the women only consists of a fringe and tail made from a species of raffia. The fringe and tail hangs from a string of beads that is fastened around the loins.

The Makraka have very few cattle. They are agriculturists and hunters, that is to say, the women cultivate the ground, while the men do the hunting. The common grains indigenous of Africa are cultivated, as are also sweet potatoes and manioc, etc.

The Flora and Fauna of the Enclave.

As regards the flora, many interesting plants grow in the Enclave. Butter trees (*Bassia*) are found nearly all over, especially in the Bari, Fajelu, and Kakwa territories, also along the Kiro-Tafari route. This tree is sometimes known as the "Lulu" by the Arabs; while by the natives in the Enclave it is known as the Engete na Mafutu—*i.e.*, butter tree. The kernels of the fruit contain a fatty oil, used by the natives for culinary purposes. The fruit is very good to eat, and I have frequently eaten it, and found it to be excellent. Some species yield a milky substance on removing a part of the bark, which coagulates spontaneously and much resembles rubber, although it does not have the same elastic properties.

In many parts of the Enclave, particularly in the territories of the Bari and the Fajelu, there are also great Tamarind (*Tamarindus indica*) trees. Some of the natives brew a beer from the fruit, and it is also used medicinally.

There are many Euphorbias, both shrubby and arboreal species, chief among them being the grotesque Candelabrum. These Euphorbias contain a milky juice, which is very poisonous. The natives use it in conjunction with rotten meat, in order to poison their arrows. The milk of another species is used by the natives in order to poison fish in the rivers.

Manioc (*Manihot utilissima*), belonging to the same order, Euphorbiaceæ, is cultivated in and around Loka, Yei, and to the south. The roots of this shrub are used as an article of food, while the leaves of the young shrubs are used for a similar purpose, and are known by the name of Pandu. We obtain our tapioca, arrowroot, and a sort of starch from this shrub. The natives have rather a curious method of treating manioc. They put the roots in water to soak for a week, and they are then taken out and dried in the sun. After drying they are ground up into flour and cooked. The skin of the manioc contains a very deadly poison, and the method of soaking it in water, then drying it in the sun, is meant to get rid of as much of the poison as possible.

Another plant commonly cultivated here is the castor oil (*Ricinus communis*). Strange to say, the natives do not use the oil of this plant medicinally, but only to smear their bodies with after washing. Every village, no matter how small it may be, must have its small grove of castor oil plants. These are usually found just outside their zeriba.

There are also a few Landolphias growing along the banks of the rivers Torrey and Yei. This is one of the plants from which we obtain the rubber of commerce. A few Ficuses (*Ficus carica*) grow between Kaya and Dufile, and also near the rapids of Fola Cataract, on the Nile. It was under one of those large trees, at Dufile, that Emin Pasha used to sit and administer justice. There are also a few Amomums and Acanthuses to be found here. The seeds of the former are sometimes used as a medicine by some of the natives.

Dragon trees (*Dracœnæ*, *Sansevieri*, and *Aloes*, all belonging to the lily order *Liliaceæ*), flourish here. From the first, we obtain a red resin

resembling dragon's blood; from the second, hemp; and from the last-mentioned, a purgative medicine.

Mimosas and acacias are very common all over the Enclave. Of the former, we have that species with the little yellow perfumed flower balls. Of the latter, the *A. horrida*, *A. nilotica*, and *A. senegal*, are found. The last-named is not so common. From it we obtain a gum. Round Loka *Erythrina tomentosa*, a deciduous tree, is common. The flowers are of a flaring red colour. The natives cut down this tree in order to make an enclosure for their village, and it is very formidable, having sharp curved thorns. Another very pretty crimson flower is *Spathodea nilotica*.

The natives, as I have mentioned before, grow many kinds of grain, among them eleusine (*E. coracana*), a millet, which is greatly cultivated, and is used as an article of food and also to make beer with. Durra (*Holcus doura*) is also cultivated, and is used in the same manner as the above. Maize, or Indian corn, is not grown so extensively in the Enclave, but Sesame or Sem-Sem, as the native calls it, is cultivated. An oil extracted from this grain is also used as a food. Hibiscus is also grown, and is used in different ways in the preparation of many native dishes.

Sweet potatoes (*Batata edulis*) are grown, as also are Yams (*Dioscorea sativa*). They are boiled and eaten just as potatoes are in England.

Tephrosias are very common. One species (*T. Toxicaria*) is employed in poisoning fish. The poison stupefies the fish, and they can then be taken out of the water by hand.

Tobacco (*Nicotiana rustica*), as I have mentioned before, does very well in the Enclave. Hemp (*C. indica*) is also grown and smoked. The Belgians are putting down the growing of this with a firm hand; and rightly, too, unless it be grown for commercial purposes, and not for the native consumption.

Two species of banana grow, the large and the small. The smaller (*Musa ensete*) is much more palatable than the former. Of the larger species the fruit is pulled before ripening and dried in the sun, then ground up into flour to be used in bread making.

The fauna of the Enclave, as is natural from its extent, is very varied. Beginning with the birds we find that there are a few ostriches in the northern part of the Enclave. Another bird that frequents this part is the sacred ibis. This bird is of migratory habits, and one of our old naturalists, writing on the subject, says, "When the Nile, after being at its lowest ebb, rose again, and the waters assumed a red tinge, then the ibis appeared in the land of the Pharaohs as a sure guarantee that the stream, the giver and preserver of life, which the people, in their profound reverence, raised to the rank of a god, would once again empty the well-spring of plenty over the thirsty land. The servant and messenger of an all-bounteous deity commanded of a necessity a reverence of a poetic and distinguished character, by reason of its importance; he, too, must be a god." And so it is to-day, as it was then when the naturalist wrote the above.

The ibis comes of the stork family. Another member of the same

family is the adjutant stork. It is generally found in pairs, and acts in conjunction with the vultures, as a scavenger. These birds have enormous beaks, and on account of this the Egyptians have named them "the Father of the Beak." There is a curious belief among the tribes to the south that the beaks of those birds smell strongly, and, on this account, no matter how hungry a man may be, he can not be induced to partake of the flesh of these birds.

Saddle-billed storks are fairly common. Then we have also the whale-headed stork (*Balæniceps rex*); but this species is very rare, as during the whole time I was in the Enclave I only saw one pair. Flamingos are many and varied on the Upper Nile reaches.

Other birds that are well represented on the Upper Nile and Lado Enclave are the herons, notably the Goliath herons and the cattle egrets. The last-mentioned are nearly always found beside grazing cattle. Sometimes you see them perched on the cattle's backs, busily engaged removing the ticks which infest the cattle's skins. The cattle egrets are nearly all white in colour, with buff-coloured backs.

Among cranes, we have the wattled crane and the crowned crane. Personally, I have never seen this last-mentioned bird in the Enclave, but I was assured that it had been seen a few times there. Bustards, rails, and plovers are also numerous.

Hornbills are well represented, and are noted for their hoarse, mocking, cackling laugh. Eagles, buzzards, hawks, and vultures are numerous. Among the smaller birds, of whom we have a large variety, we find redstarts in and around Rejaf and Lado; and cuckoos (*Cuculus canorus*) have been seen on one or two occasions here. Waxbills, Abyssinian weaver birds, turtle doves, kingfishers, martin-fishers, bee-eaters, (*Merops bullockii*), yellow chattering sparrows, and wagtails, pied and grey, are all very common.

The Fajelu treat the wagtails with every kindness—even go the length, when their durra is ripe, of placing a bunch of heads of this grain on top of their huts for those birds. They are very tame, and hop in and out of the huts, well knowing they are safe from molestation. For a native to kill a wagtail knowingly, would, according to their belief, be only to court misfortune and disaster. These are the only birds I have ever heard whistling in Central Africa, and on this account they are very welcome to Europeans.

Reed warblers, fantail warblers, widow birds, roller birds, finches, blackbirds, sunbirds, honey-suckers, and goat-suckers, or nightjars are also very numerous.

Guinea fowls are numerous throughout the Enclave, and go about in flocks of ten to twenty each. There are also a few partridges.

There are many more species of birds in the Enclave than those I have enumerated above, and I would have been able to give a fuller and better list, perhaps, had I not had the misfortune to lose between sixty and seventy birds of a collection I had.

Apart from birds the fauna is abundant and varied. The maned lion is fairly common, and there are many leopards which are more to be dreaded than the lions.

Hyenas are also very numerous, and when night comes, they create a terrible noise, making it impossible for one to sleep at times. In addition to the leopards, we have many other species of the cat tribe, including the servals, *Felis serval* and *Felis caligato* being among the most common.

Among the larger animals abounding in the Enclave we have the elephant. These animals attain great size, and some have remarkably fine tusks of ivory. They roam about in herds and are very numerous towards the north-west. I once saw a herd of sixty of these animals near Bandukia. On another occasion I very narrowly escaped being trampled upon by a rogue that had been driven out of a herd.

Hippopotami are very scarce in the Nile from Kiro to beyond Rejaf. Beyond Bedden they are very numerous, and I have seen, just south of Dufile, as many as thirty heads above the water at one time. So numerous are they at this part, that it is extremely difficult to get a native to undertake a journey on the Nile there in a canoe, after nightfall.

Rhinoceroses are also numerous, two kinds being known to exist here. The rhinoceros is generally an aggressive sort of an animal, and will attack one without the least provocation, but they are easily dodged, as they are such great ungainly animals. The only other animals here that make for one without the least provocation are the buffaloes. The wild pigs or bush hogs are plentiful, as are also the water hogs. Towards the north there are a few wild asses and zebras, also a great number of beautiful giraffes.

The antelopes, of which there are many species here, are particularly numerous, chief among which are the Hartebeests, or "Songola," as they are named in the native vernacular. They are very inquisitive animals, and will often let one up to within shooting range before springing away. Their flesh is excellent to eat. The water-bucks are well represented in the Enclave, especially in these parts around Bedden, which literally teem with them. The native name for water-buck is "Burongo." I saw hundreds of Burongo in the bush around the above-mentioned place, many fine heads being among them. The female Burongo does not carry horns.

In the Mundu territory there exists a most beautiful waterbuck, *Cobus maria*, or Mrs. Gray's waterbuck, as it is more commonly called.

Then we have the Eland in the bush between Loka and Kajo-Kajo. I once saw a herd of about twenty of these beautiful animals near Loka. This is another rare and beautiful animal that is fast becoming extinct.

We have a host of smaller antelopes also, such as the dik-diks, the duikers, klipspringers, and a few others. Some of the dik-diks are tiny little creatures with short horns. We have also an Abyssinian species of bush buck. Only a few oryx are to be seen. Gazelles are also well represented, common among them being Grant's and an Abyssinian species, and some others.

The monkey tribe are numerous. The beautiful black and white *Colobus guereza* are found on the trees along the banks of the rivers or

khors to the south. There is also a little brown, inquisitive species, which causes great destruction among the manioc and sweet potato plantations. There is another form, which inhabits the hilly grounds, and is known as *Cercopithecus grisco-viridis*. This monkey is a very timid animal. Baboons (*Cynocephalus*) are very numerous.

From a hunter's point of view, the Lado Enclave leaves nothing to be desired, as nearly every animal and bird indigenous to Central Africa is to be found here. There are many species of animals that I have failed to mention in this article; for to mention all would be a task quite beyond me.

The Commercial Possibilities of Lado and the Lado Enclave.

Apropos of the recent agreement entered into between this country and the Congo Free State in regard to the Lado Enclave, I venture to give a few notes upon Lado as a future commercial centre—but before doing so, perhaps it would be better to give here the substance of the agreement. It is as follows:—

The lease of the territory on the Upper Nile, known as the Lado Enclave, extending from 2 deg. 18 min. to 5½ deg. N. Lat., and from the White Nile to 31½ deg. E. Long., leased to the Congo Free State in 1894, is to be annulled, and the King of the Belgians, as Sovereign of the Free State, is to continue in occupation of the Enclave under present conditions, so long as he reigns.

A railway has to be constructed from Lado to the Congo frontier, and the Egyptian Treasury is to guarantee the interest required on a loan for the construction of this railway, and also for the working of the same.

A railway such as that proposed ought really to have been constructed long ago, for the Free State has spent no little in introducing locomobiles, mules, and donkeys, in order to try and solve the transport question. In addition, thousands of porters are required every month by the State for transport purposes; and, when one considers that some of the difficulties arising between the State and the natives are due to the aversion of the native to this transport work, then it seems clear that a railway ought to have been made long ago. About one half of the troubles in the Free State arises from the transport question alone. I am told by a reliable authority that the Enclave costs about £100,000 yearly, but this sum might be greatly reduced were things done in a more businesslike way. As an example of the way things are done take the following. Locomobiles weighing seven tons (when empty) were bought and sent out to Lado and Rejaf *via* the Nile for transport purposes at a great outlay. When tried they were found to be too heavy for the primitive roads and bridges of the region, and they could not be used at all in the wet season, while the scarcity of water in the dry season made their use then difficult. The persons sent to England (where they were bought) to select them seemed to forget that although they did very well at the trial on the well-made and well-kept roads of this country, they might be unsuitable for the bogs and marshes of the

Enclave. Subsequent trials proved them to be totally unsuitable, and so they lie (three of them) at Rejaf, as so much scrap iron of no use to any one, except as monuments of the folly of the persons who were sent to select them.

But leaving this affair, we may take up the question of the proposed railway from Lado to the Congo frontier.

Now there are two routes by which this railway might go in order to reach the frontier. One is to run parallel with the Nile to Mahagi on Lake Albert, and the other is from Lado to Faradge, by way of Rejaf, Loka, Yei, and Aba.

Let us see what each of these routes has to recommend it as a prospective railway. We will take the one that would run parallel with the Nile first and discuss its merits. The starting-point, of course, would be Lado, and the line would go over rather marshy ground, over the Loret Khor and also that of Koda on to Rejaf. From Rejaf it would continue to run parallel with the Nile to Dufile, passing the Kaya River about half-way. On leaving Dufile it would leave the Nile for a little, but would gradually work round again to it, and continue to run almost alongside of the river to Wadelai, thence to Mahagi. I may say that this line has already been surveyed in connection with the one that is already being built to the Great Lakes. On this route, from Lado to Mahagi, the native population is rather scanty, and the soil is poor and somewhat stony. The poverty of the soil doubtless accounts for the scanty population.

One of the good results a railway down in this direction would produce is that it would be the means of opening up that vast fertile district, the High Ituri, to the occupation of the white man. The great forests of rubber, etc., would then undergo rapid development.

There are no serious difficulties in the way of railway construction in these parts except bridging the many khors and marshes.

Now let us take the other route. Starting from Lado the land gradually rises from about 800 ft. above sea-level until it reaches Loka, where it attains a height of 3500 ft., the distance being about sixty miles; thereafter it gradually falls away again. This line would pass through a populous district, and at the same time a very fertile one. The natives in the vicinity of this line are an agricultural race, cultivating vast crops of durra, maize, millet, etc. The effect of a railway through these parts would be first to solve the transport question, and second to produce increased crops, for instead of a certain number of natives having to give their services to the State for transport work, they could get "back to the land," and the result would be a larger tract of territory cultivated, thereby causing increased crops.

This last mentioned route is the one selected by Greek, Indian, and Arab merchants, who come from Khartum and Uganda to trade in ivory, etc. They employ porters, who are paid at the rate of about five rupees per mensum, which is rather costly for the merchant, if he has, as he often has, about thirty porters, and is away for months at a time.

Now with Port Sudan open, I venture to predict that much of this trade, which formerly found its way to Mombasa *via* Uganda, will go by

way of the Nile to Port Sudan, it being more advantageous to send produce this way. Were we in occupation of the Enclave at this moment, it would be feasible to build a light railway from Lado to the southern parts of the Bahr el Ghazal, in order to open up the rich provinces there.

It is a well-known fact that the Bahr el Ghazal and Jur rivers are only navigable for about six months in the year, and only for about 400 or 500 miles, so those rivers as a means of opening up and developing a territory which is five times larger than England are practically useless. On the other hand, we have the White Nile to Lado, and this, with a railway from Lado such as I propose, would go far towards solving the difficulty in opening up at least the southernmost provinces of the Bahr el Ghazal, and thus bringing them within say fifteen or sixteen days from Khartum, whereas at present they are a few months' distant.

With a railway from Lado to the Bahr el Ghazal, one would be able to get, in fifteen days' time, to the rich territory of the Dinka, with its numerous ebony forests, the cotton plantations of the Bongo, and the rubber forests of Ndoruma, and the rich mineral deposits of the Bahr el Ghazal generally.

I put the foregoing railway scheme before the readers of the *Scottish Geographical Magazine* as an easy means of access to those parts of the Bahr el Ghazal that I have already mentioned.

In the near future, when these schemes are accomplished facts, Lado will become an important place, and will be a port of some importance, as the greater part of the trade of Upper Egypt and Central Africa will go through it, on the way to Khartum and Port Sudan, *en route* for Europe.

The commercial possibilities of the Enclave are great. Very good cotton is found growing wild near Rejaf, Lado, and Kiro. Emin Pasha planted cotton here and found it do very well. The Belgians still more recently planted cotton, and it was found to be quite a success. There is a very good species of cotton, which I think would do very well here, and that is the kind known in Egypt by the name of Ashmuni. The experiments that were tried were highly successful, and the young plants were singularly free from that pest, the bollworm. The cotton was sown about the beginning of April, and was ready for the first picking about the end of September. Labour is very cheap, and the cost of clearing, planting, tending, and picking an acre of cotton—at the rate of wages obtaining here—would amount to something like £3, while the probable return of cotton per acre would amount to not less than £20. This leaves a very good margin. With such good rich soil as that of the Enclave, with proper attention to the quality of cotton planted, and with good management, the return per acre could be very much increased. I think that cotton cultivation in the Enclave offers immense possibilities to the capable man, even although his means are but slender. Another thing that could be grown for profit here is coffee. Some kinds of coffee are said to grow well at an altitude of 3000 feet above sea-level, and require shade in order to do well. The large Bassia and Tamarind trees could be made answer the above purpose well, and there are many of the

above trees in the Bari and Fajelu territories, and in the higher parts. In the latter *Coffea arabica* could be favourably grown, and in the lower districts *Coffea liberica*.

Tobacco (*Nicotiana rustica*) grows splendidly here; and I have no doubt were some of the other kinds tried, they would do equally as well. Tobacco is a very hardy plant, and requires very little attention. The returns expected from an acre of tobacco should be about 1000 lbs. The cost of raising this would amount to a little over that required for cotton raising.

Ground nuts (*Arachis hypogea*) are cultivated extensively, and could be extended. They are worth in London and Liverpool from £6 to £13 per ton. They turn out about one ton and a quarter per acre, and cost for planting and cultivating about £2 per acre.

Bamboos grow in great profusion from Papwa to Loka. They could be made to serve as paper-making agents. Very good paper is made from bamboos in China; and they are largely exported from the West Indies to America for a similar purpose. Bamboos can also now be used for a variety of purposes, such as water pipes, fishing rods, walking sticks, etc., while the young shoots are cooked and eaten, much in the same way as we would cook and eat asparagus.

Another tree that grows well, and could be grown for commercial purposes, is the "Eweile" or Horse-radish tree (*Moringa pterygosperma*). However, there are only a few here in Rejaf, Lado, and Kiro. This is a very pretty tree, with its long racemes of white flowers, and its long seed pods. The seeds, which are known as Ben nuts, yield forty-two per cent. of oil, when crushed, and the value of a trial shipment from West Africa fetched £7 per ton in Liverpool.

From the above one can see that this district could be made a success from a commercial point of view, even although one only planted cotton and ground nuts, with tobacco. An important industry could be started with the product of the latter plant. Egypt requires quite a large quantity of tobacco for the manufacture of cigars and cigarettes. It is a well-known fact that she imports most of the tobacco she uses from Turkey. With good tobacco cultivated in Upper Egypt, she would practically be independent of the supply from the Turks; and possibly be able, after a few years, to grow her own supply.

THE PROGRESS OF NEW SOUTH WALES.[1]

THE publication named below brings together a large amount of information in regard to New South Wales, a State of much interest to the geographer as affording an example of a new community in process of adjusting itself to its natural surroundings. The chapters on commerce, industry, population, and so forth are of special value in that they record a series of oscillations about a position of equilibrium of

[1] *The Official Year-book of New South Wales*, 1904-5. By W. H. Hall. First Issue. Published by authority of the Government of the State of New South Wales. 1906.

which the history of older and more slowly moving communities affords fewer traces.

Before proceeding to quote some figures, it may be well to recall the fact that New South Wales has a total area of 310,700 square miles (the length of the State from Point Danger to Cape Howe being 680 miles, and the width along the 29th parallel 760 miles), that is more than two and a half times the area of Great Britain and Ireland (121,180 square miles); and a population, on March 31, 1901, of 1,359,133, that is a density of 4·38 per square mile; or taking the figures for the estimated population in 1905, which is 1,496,050, we have a density of nearly 5 per square mile, a very low figure as compared with Old World States!

The surface of the land is divided into three well-defined but very unequal regions:—the Coastal District, with an average width of 35 miles, the Table-land, with an average width varying from 30 to 100 miles; and finally the vast Western plains, which feed the innumerable flocks which are the colony's chief source of wealth. On the map this great plain would appear to be well-watered, but the unsatisfactory nature of the streams, and the terrible droughts from which the region suffers periodically, are familiar facts.

The importance of the pastoral industry may be gathered from the fact that in the years 1902-4 wool represented 53·8 per cent. of the total value of the oversea domestic exports. In 1904 the total trade was over £60,000,000, or more than £40 per head, the exports being £33,000,000, and the imports £27,000,000, giving a balance of exports over imports of nearly five and three-quarter millions. Next to wool the most important single article of export was wheat, the total value of the wheat exported in 1904 being nearly £1,400,000.

In regard to the wool trade a recent change of some interest is the growing tendency for buyers on the Continent of Europe to purchase direct in the Sydney market rather than from the London brokers. A little more than twenty years ago practically the whole crop found its way to London, while now more than half the total goes direct to the Continent. From the colonial point of view this change is stated to be a desirable one. A new customer for wool has been of late years found in Japan. As regards the countries with which trade is carried on, that with the United Kingdom is greater than that with any other country. During the last fifteen years, however, the imports from the United Kingdom, with minor variations, have been practically constant, and are now over one million less than twenty years ago. On the other hand the imports from foreign countries have been steadily increasing. The report states that this diversion of trade is probably apparent rather than real, as formerly goods were sent to London for distribution, while now there are many lines trading direct with the Continent of Europe and America. This must, however, surely mean that there has been a considerable loss of carrying trade to the United Kingdom. The exports show similar characters—that is both absolutely and relatively the exports to foreign countries have increased at the expense of those to the United Kingdom.

Although the manufacturing industries in New South Wales are not very extensively developed, yet they are by no means insignificant. In 1904 the number of manufacturing establishments is given as 3632, and these employ 68,000 hands, while the invested capital is about £20,000,000. A marked feature of the development of manufacturing industries has been the increase in the number of females employed, there being now 27 females for every 100 males employed. The increase is specially marked in the clothing industries. Child labour is also increasing, over one-tenth of the females employed being under sixteen years of age. As in other countries where child labour is frequent, there is reason to believe that the ages of young persons engaged in the industries is often incorrectly stated, for by law a permit is necessary for the employment of any young person under fourteen. The manufacturing industries are naturally best developed in the urban areas; Sydney, with its numerous natural advantages, being an important seat. According to the Report the abundance of coal, iron and other ores, as well as of raw material of various kinds, specially fits the country to become a manufacturing one, but meantime the small and scattered population is a drawback. But some figures are given below which indicate that a steady drain of the population into the towns must be going on, and if this continues, and the population fails to increase faster than it is doing at present, there seems much probability that the supply of raw material at least will soon diminish for want of a rural population to develop the land. But the evidently strong desire to develop the manufacturing industries in the country is of great interest to the geographer no less than to the student of economics. It is not infrequent to find Australian papers strongly urging that local manufacture must be fostered at all costs, because manufactures mean a rapid increase of population. The birth-rate of most of the States is low and decreasing, but it will be of much interest to learn whether the development of manufactures will cause it to rise. An increase of child labour and of female labour generally means a high birth-rate—at least in the old countries. Will it have the same effect in New South Wales?

Some interesting statistics are given as to the different industries, but these cannot be discussed here. In regard to employment and production, of the total population in 1901, about 173,000, or nearly 24 per cent., were engaged as producers of raw material, as against about 147,000, or 17 per cent., engaged in industrial pursuits. Of the primary producers the majority were engaged in agriculture, then in order come mining and pastoral pursuits, while very much fewer are engaged in dairying. In the trades the wages for artisans varied in 1904 from 9s. to 11s. per day, while the wage of farm labourers was 16s. per week, with board and lodging. The board, we imagine, still as formerly consists of "damper, mutton, and tea." On the other hand, a domestic servant can command a wage of 10s. to 17s. per week, with board and lodging, both board and lodging in this case being, we should imagine, of a much superior character to that which falls to the lot of the farm labourer. It is these figures which are of so much significance in connection with the future development of the country. New South Wales

must have abundant raw material to send to the world's markets in order to pay off her indebtedness, and yet not only is the population scanty, but the whole trend here as elsewhere, but even more markedly, is from the rural to the urban areas.

Among the numerous details given in the Report as regards the pastoral industry, we note especially the following points. In the year 1891 the number of sheep in the State reached the grand total of nearly 62,000,000, but as after this there was a series of years of drought the number rapidly dropped. The climax was reached in 1902 when the number dropped from 41,800,000 at the beginning of the year to 26,600,000 at the close of the year—an enormous drop from the 1891 figures. Successive years of drought were responsible for this, but it is to be noted that as the sheep are kept for their wool and not for mutton, there is a constant tendency for the natural increase to be greater than the resources of the country will permit. In the future this may be avoided by the cultivation of artificial fodder, but meantime it is very obvious that the flocks increase faster than their food supply. The sheep which are chiefly bred are merinos, and the flesh of these is apparently neither appreciated in the local market, nor abroad as frozen meat. Efforts have been made to breed sheep more suitable from the butcher's point of view, but as a different kind of sheep is necessary for this purpose, this simply involves the splitting of the industry into two branches, and does not solve the problem of over-stocking. The cure of the latter probably partly lies in the growth of artificial fodder, and partly in combining sheep-farming with agriculture.

The cattle of the State number 2,000,000, which is an increase on the figures for 1902 and 1903, but a decrease as compared with 1881. The increase has been partly due to the increased attention given to dairying, which has led to an increase in dairy cows. The consumption of meat in the State, as in the Commonwealth as a whole, is enormous, each inhabitant consuming nearly two-thirds of a pound per day, and as, probably for the reason given above, beef is preferred to mutton, almost all the cattle slaughtered are required for home use. During the year 1904 barely £130,000 worth of frozen meat was exported from New South Wales to the United Kingdom, and of this beef formed but a small part.

In agriculture the progress of the State has been slow. The region adapted for agriculture in the strict sense is the eastern region, together with most of the central region. The western plains have too irregular a rainfall to be suitable for this purpose. But it is estimated that in the other districts mentioned about 50,000,000 acres are suitable for cultivation, and of this during the year ending on March 31, 1905, barely 3,300,000 acres were under crops and sown grass. In other words only about 2 acres per head of the population is under cultivation, and only 1·3 per cent. of the total area of the State. The most marked increase of late years has been due to the laying down of land to wheat, and the wheat-growing lands now form 66·5 per cent. of the total cultivated area. It is estimated that some 25,000,000 acres of land are available for wheat-growing, and of this only $1\frac{3}{4}$ millions acres are

actually under wheat. The average yield is 10 bushels per acre, as compared with 32 bushels per acre in Great Britain. On the other hand, the Australian wheat commands a higher price than the British. At present the actual production of wheat in the State does not always cover the local demand. Thus there were deficits in 1899 and 1903, and invariably prior to 1897, the first year in which there was an apparent surplus. There is much land in the State suitable for the growth of maize, but little progress has as yet been made with this cereal, and of recent years there has been a regular import from elsewhere every year. Oats, barley, hay and chaff are also all imported into the State, while the same tale of small production is told of tobacco, sugar, the grape-vine, fruits, and so forth. Obviously there is much room for improvement in almost all branches of agriculture. In the last few years dairying has made great progress in the State, as in the Commonwealth, and Australian butter now competes successfully with the Danish product in the London market. Almost all the product is factory-made, the farmers sending their separated cream to the factories.

The above facts are of great interest as showing that in a modern and highly individualised community the course of development is by no means exclusively determined by geographical conditions. There is an enormous land area apparently capable of agricultural development in New South Wales, the local market in regard to many natural products is not yet satisfied, and in the United Kingdom and elsewhere there is an almost inexhaustible demand for food-stuffs, and yet the efforts of the State appear to be directed rather towards the establishment of manufactures than to the exploitation of the land. This is the more remarkable in that, even as regards the local market, the products of the developing manufactures must compete against those of long-established concerns elsewhere, while in the task of conquering the world's markets the State manufacturers start with a heavy handicap. The cause of the strong desire to develop the manufactures, as already hinted, is social, but it is interesting to note that in the report before us we have been unable to discover any indication of that reaction which in the Old World expresses itself in the cry "back to the land."

As regards population, the annual increase between the censuses of 1891 and 1901 was barely 2 per cent., and of the total increase of 227,000 only 223 was due to the excess of immigrants over emigrants, so that during this period the State was practically dependent upon the excess of births over deaths for increase of population. Since 1901, on the other hand, there has been a considerable immigration into the State, though this is largely due merely to movements of population within the Commonwealth, and not to immigration from the outside. Thus during 1905 the excess of arrivals, excluding those from the Commonwealth and from New Zealand, was only 160. It is stated, however, that during 1905 great and successful efforts were made to attract immigrants from regions outside New Zealand and the Commonwealth.

At the end of December 1905 it was estimated that there were about 113 males to every 100 females. This is very nearly the reverse of the figures for the Kingussie district in Inverness-shire (cf. the June

Magazine). Of the total population 68·63 was urban and only 31·37 rural in 1901, and in the ten years from 1891 to 1901 the urban population increased three times as fast as the rural. In detail the figures show that the increase of the urban population is not solely due to the tendency of immigrants to remain in the towns, but also that the towns are attracting some part of the natural increase of the rural districts. To some extent this is explicable as the result of the predominance of the pastoral industries, which demand but few hands, while the fact that the wool is exported to other countries necessitates a considerable amount of labour in the port of exit, which is Sydney. Other causes have been suggested above. Of the total population nearly 15,000 are coloured aliens, chiefly Chinese, which number over 10,000, or, including half-castes, over 11,000. The fact that of the grand total under 700 are women is one reason for the bitter hostility which has been aroused by the influx of Chinese. Another is their skill and success in certain industries, notably in cabinetmaking, which is largely in their hands, and in market-gardening and laundry work. The aborigines are fast disappearing, the annual decrease being about 1 per cent.; only 3700 full-bloods were returned in 1901, and about the same number of half-castes.

So much has been said of the falling birth-rate in New Zealand and Australia, that it is sufficient here to state that relatively to the birth-rates of Europe that of New South Wales is low, and falling with some rapidity, though the 1904 figures show a slight improvement on those of 1903. The high rate of illegitimacy in New South Wales may, however, be alluded to. In 1904 of the total births 7·12 per cent. were illegitimate. The importance of this is best realised by noting the high death-rate among the illegitimate children. This is nearly three times as great as among the legitimate, so that in a State where every birth is rapidly becoming of great importance there is a constant and needless drain of infant life. Further, the death-rate in childbirth is much greater in illegitimate than in legitimate births. Among married women the death-rate in child-birth is 1 in 145 cases, and among the unmarried 1 in 95. It is thus clear that the high rate of illegitimacy is a real danger to the community.

Under food and prices there is a large amount of interesting information which can only be briefly alluded to here. The cost of food is decreasing; exclusive of intoxicants, it was, in 1904 9·4d. per day per head, as compared with 10d. per day per head in 1892. Rents are still high; it is calculated that a labourer must set aside at least 25 per cent. of his income to cover this item.

We have in the above summarised certain parts of the new Year-book, but it must be realised that it contains in addition an enormous amount of useful information, and is to be cordially welcomed to the ranks of books of reference. We think, however, that it would have been well to point out in the preface that information for previous years is available elsewhere in Mr. Coghlan's valuable works. It is to be hoped that the new volume will serve the purpose of attracting to the shores of the State a number of the kind of immigrants necessary to develop its vast resources, which still await full exploitation.

A LITTLE-KNOWN MOUNTAIN PASS IN THE PYRENEES.

We may take it that, of all the mountain passes in Europe, none are probably older as trade routes than the passes across the Pyrenees. One reads of Roncesvalles and the Pas de Roland in the days of chivalry; and away back in the times of the Goths, horde after horde must have swept over the more accessible routes through the great mountain chain. But while these great waves of invasion probably took the line of least resistance round by the sea on both sides, we must suppose that the more peaceful traders on either side would conduct their commercial traffic by the more direct, but less well-known and less accessible passes through the mountains. Even to-day, the Spanish contrabandista forms an unfailing source of inspiration for the story-teller; and the Spanish muleteer still leads his string of gaily-caparisoned mules through these passes.

Brigandage may be on the wane, and the muleteer may not be so picturesque as of yore, but the passes are still there in all their beauty and grandeur, and the country is unspoilt by the tourist.

One of these mountain passes is the subject of a paper which appears in the *Boletín de la Real Sociedad Geográfica*, vol. xlvii., translated from the French of M. Lucien Briet. It is called by the French the Pass of Gavarnie, leading from the country round Barèges to the Spanish side of Mount Perdu; Gavarnie is the frontier, and its watershed, which has an altitude of 2255 m., is drained on the north by the Gave de Pau to the Adour, which reaches the ocean at Bayonne; and on the south by the Ara, a tributary of the Cinca, which flows in its turn into the Ebro, and so passes into the Mediterranean.

The Pass of Gavarnie, otherwise the Puerto de Bujaruelo, as the Spaniards name it, has for its chief beauty the ravine which conducts the traveller from the *col* to the village of Torla. The top of the pass registering 2255 m., and the village 1031 m. more or less, it follows that there is a considerable fall between the two points. Starting from the summit, one sees the masses of Tendenero and of Otal, Gabiétou and Escusana towering up close by. The road is by no means good, and while typical of those of upper Arragon, contrasts unfavourably with those of the French side. Shortly, the Ara comes into view, and then the descent becomes very rapid and stony. The first village to be reached is Bujaruelo, or Boucharo, which is in truth merely a cluster of houses occupied by the carabineros, and a hospice which was used in very early times for the protection and shelter of travellers who might be caught in bad weather in the pass. The travellers from the French side generally breakfast here. There are twelve men of the customs at this point who range the mountains in pairs, sometimes being found as far afield as the Pas de Roland; and one of these men will escort your baggage to Torla, if you have any. It is after leaving Bujaruelo that the best of the gorge is seen. Rock masses rise on both sides, covered with box, pines, beeches, etc., and after passing the hermitage of Santa Elena, the stream takes rapidly downwards between giant rocks which

rise up as a wall on either side. This is the true gorge, which cuts deeply through the mountain, and opens out below at Torla. Formerly the road was carried up to the right, over the Peña de Lomeñas, one of the pillars of the gorge, and came down as a staircase into the plain below. Many parts of the Pyrenees have had to be approached in this manner; but now in this case a cornice has been cut or rather blasted along the other side of the stream, and a path has been made which is looked on as the forerunner of a carriage road uniting France with Spain. The importance of this pass is twofold: firstly, it is a scene of great beauty which is little known, and in fact has only been described by two authorities, Packe in his *Guide to the Pyrenees*, and Lequeutre in the *Annuaire du Club Alpin-Français*; and, moreover, because it promises to be an increasingly popular route between the two countries. Another point is that Torla is not very remote from the line which ends at Jaca; and as this is to be the terminus of the most easterly of the three Trans-Pyrenean lines which it is proposed to construct in order to further communication with France, the approach to Torla will be much simpler.

Torla itself seems very quaint; it bears the marks of the Moorish domination on its buildings; the very name of the parish priest is Abenoza, which surely indicates Moslem descent. The houses have the double window, the *ajimez*, just as one sees them in Andalusia. A photograph is given of the famous cross of Torla, a beautiful piece of Gothic work in silver gilt, which is in the church. As the writer says, any museum might be proud to possess it.

We have given a very inadequate description of an article having for its object to make known to the travelling public a district which will repay the exertion entailed by a visit. The photographs give a very good idea of the grandeur of the scenery.

GEOGRAPHICAL NOTES.

Europe.

The Origin of Certain Swiss Lakes.—Professor E. J. Garwood publishes a paper in the *Quart. Journ. Geol. Soc.*, London (xlii. p. 165), on a bathymetrical survey of certain of the lakes of the Canton Ticino. The lakes of Switzerland fall into two great groups, in the first of which are included the large lakes found on the outer zone of the Alps. These lakes are the *Randseen* of continental authors, and receive the drainage of the principal Alpine valleys. Into the second group fall the lakes, called tarns in England, which lie *in* the mountain region and themselves drain into the great valleys. It is with certain of the later lakes that Professor Garwood is concerned. His researches include the lakes of the Val Piora, the Lago-Tremorgio group, the lakes lying near the summit of the St. Gothard pass, and the Lago d'Elio. His paper is illustrated not only by a series of bathymetrical maps, but also by a set of beautiful views, which we recommend to the notice of those familiar with this part of Switzerland. It is of interest also to note that Professor

Garwood succeeded in devising a sounding machine which could be used from the bank, and gave very accurate results. This machine is not described in the paper, but its use is a matter of great interest, for many of the higher Swiss lakes, like a few of the Highland lochs, have no boats on their surface, and the conveyance of boats thither is in many cases impossible, or virtually so.

Professor Garwood's research was specially undertaken to solve the problem whether or not the lakes under consideration owe their origin to the action of ice, for almost all lie in rock-basins of the type usually ascribed to ice-action.

The lakes of the Val Piora lie in a series of hollows in and round the mountain valley of the same name, which has itself been carved out of a series of limestones and schists which have been squeezed in between two masses of gneiss. The author believes that no one of the lakes examined in this valley can owe its origin to ice-erosion. He believes that in the district generally there has been differential erosion depending on differences of geological structure, and greatest where the rocks are rich in calcite and dolomite. The soundings show that the axes of greatest depth of all the lakes lie along the junction of calcareous and crystalline rocks. The formation of the valley in which the lakes lie has, he believes, been determined by the presence of thrust-planes, while the overdeepened portions in which the lakes lie owe their origin to the special solubility of the rocks in the areas in which they occur. The well-marked hanging-valleys around Lago Ritom he explains as the result of a recent reversal of the drainage of the Val Piora.

Without considering in detail the conclusions arrived at in regard to the other groups of lakes, it is sufficient to say that the author sums up by saying that the lakes examined can be grouped as follows:—1, those (*a*) entirely or (*b*) partially dammed back by loose material; 2, true rock-basins, due (*c*) to solution or (*d*) to weathering. Of all four divisions he believes that there is a possibility of the excavation of a rock-basin by ice only in 1*b*, and here he considers this explanation unlikely. In group 2 he concedes that glacial erosion may have had some effect, but rather in removing weathered material than in excavation proper. He adds, however, that certain of the rock-basins are difficult to explain on any hypothesis.

The Insolation of Switzerland.—A note in *La Revue Générale des Sciences* for May 30 gives an abstract of a recent Swiss paper, containing a summary account of the amount of sunshine registered at seven typical stations, during the years 1891-1900. The stations were Berne and Basel, as representing towns placed on a plateau traversed by a river, Lausanne and Zurich as representing towns besides lakes, Lugano as a station in the southern Alps, Davos as a high Alpine station, and finally the summit of the Säntis, a height of 2500 metres.

The results are as follows:—At Basel and Berne the mean annual amount of sunshine registered is respectively 43 and 42 per cent. of the possible amount, the maximum being in August, and the minimum in November in Basel and in December in Berne. From January to April

there is a rapid increase in the insolation, while in May there is a sensible diminution. Zurich and Lausanne show a similar curve, with means of 43 per cent. at Zurich and 47 per cent. at Lausanne. The maximum is again in August in both, the minimum in January in Zurich and in December in Lausanne. At Lugano the conditions are somewhat different; there are two maxima, the first in July with 69 per cent., and the second in February with 60 per cent., and two minima, May with 51 per cent., and November with 42 per cent. The mean annual percentage is 59.

At Davos there are similarly two maxima, the first in August with 60 per cent., and the second in February with 55 per cent., and two minima, May with 47 per cent. and January with 49 per cent. The mean annual percentage is 54. At the summit of the Säntis the maximum is in November (51 per cent.), and the minimum in June (35 per cent.). The mean annual percentage is scarcely 42, this being explained by the fact that on mountains there is winter insolation; in the summer the summit is clothed in fog and cloud on account of the elevation.

Asia.

Mountaineering in Kashmir.—Dr. and Mrs. Bullock Workman have been continuing their exploring work during the present season, and according to a telegram dated August 16, Dr. Workman has ascended a peak 23,000 feet high in the Nunkum range. Dr Workman with his wife and Italian guides and porters camped for two nights at an altitude of more than 21,000 feet. It is believed that this is the highest camp ever made by mountaineers.

Dr. Sven Hedin's Expedition.—According to a telegram dated August 2, which has been received at Stockholm from Leh, Kashmir, all is going well with Dr. Sven Hedin's new expedition. The explorer seems well satisfied with his caravan, which consists of 120 persons, and considers the outlook for his further journey promising. The last news previous to the present telegram will be found noted on page 325 of the present volume of the *Magazine*.

Africa.

Ruwenzori.—The Duke of the Abruzzi has successfully accomplished the ascent of this mountain, having reached the summit of its seven highest peaks. He arrived at the top of Kiyanja by the valley of Mubuku, and gives its summit as 5500 metres. By the Congo slope he then ascended Duwoni, whose height is given as 6000 metres. He then passed into a hitherto unknown river-valley, called Buigbu, fed by the glaciers of Duwoni, and traversed its whole length. The ascent of the highest summit was accomplished on June 18. The three highest peaks have been called by the Duke, Marguerite Peak, Queen Alexandra Peak, and King Leopold Peak. The others have not yet been named. The above details are taken from the *Tour de Monde* for September 1. If

they correctly represent the Duke's results, it will be noted that the heights agree much more closely with Sir Harry Johnston's estimate of 20,000 ft. for Ruwenzori, than some recent estimates (cf. this *Magazine*, p. 380). It is obvious also that there must be great confusion in the nomenclature of the peaks, for those climbed by the Duke can hardly be the same as those climbed by Messrs Wollaston, Woosnam, and Dent.

Sleeping Sickness in the French Congo.—This dreaded malady rages in the French provinces of the Upper Ubangi, and is even common in Gaboon and Libreville. In consequence the Geographical Society of Paris has organised a mission to West Africa to study the disease. A sum of £8000 has been collected, and the mission is to leave Paris during the present month for Brazzaville. Here a permanent central laboratory will be established, and then the mission will begin the direct study of the malady up country, and especially in the Upper Ubangi region.

The Lenfant Expedition.—On August 25 Commandant Lenfant, accompanied by Captains Joannard and Periquet, Dr. Kérandel, M. Bastet, Dr. Heckenroth, and others, left Bordeaux on an exploring mission to the French Congo. He goes first to Matadi and Brazzaville, from which latter point the real expedition will begin. From Brazzaville the Congo will be followed till the entrance of the Sanga, and this stream will be ascended to Nola, the point where the Mambere and Kadei unite to form the Sanga. At Nola the expedition will halt for some time to study the immense forest there, and will then ascend the Mambere to Bania. So far the route will be the same as that followed by Commandant Moll in the German Mission for the delimitation of the Kamerun frontier, but at this point Moll's route will be quitted, and the expedition will follow the Mambere to Carnot. From this point the exact route is uncertain owing to the want of maps. The object is to reach the Laka country, which lies between the depression of the Tuburi and the Upper Logone, and to investigate the possibility of linking up by navigable routes the basin of the Logone with that of the Sanga. Commandant Lenfant's present expedition is thus as it were a continuation of his previous journey, which was fully detailed here (vol. xx. 1904, p. 306). A glance at a modern map will show how large an area of absolutely unknown country still exists in the region between the Congo basin and the Lake Chad region, and as part of the region is known to be inhabited by hostile and cannibal tribes the expedition is likely to be hazardous in the extreme.

Mount Meru.—Dr. Fritz Jaeger gives, in the *Geographische Zeitschrift* (xii. 5), an account of observations made in the vicinity of Mount Meru by the members of the Otto Winter East African Expedition, which was under the leadership of Professor Carl Uhlig. Mount Meru lies west-south-west from the well-known volcano Kilimanjaro, and attains a height of about 4630 metres. Of this height roughly 600 metres are due to gneiss and quartzite, so that the actual volcanic cone is about

4000 metres high. For the most part the cone has a gentle slope, the regularity being broken, especially to the south and west, by parasitic cones. To the west indeed there is a *Vorland* which rises to a height of between 2400 and 3000 metres, presents a steep wall to the plain, and must have been entirely due to the activity of closely aggregated parasitic cones. To the north the mountain rises steeply from the flat steppe, while to the east the base spreads out into a lake-strewn plain, which slopes gradually to the north and east, but is separated from the southern plain by a steep front. From this steep edge there stretches to the south-east a ridge with parasitic cones, clothed with rain-forest.

The summit of the volcano is crowned by a crater with steep walls, except to the east, where the wall has been broken down and a huge gap remains. Through this gap there flowed, probably not more than a hundred years ago, a stream of lava, which must have been of a very viscous nature, and has solidified in great blocks with gaping crevasses between, the whole presenting a curious resemblance to a glacier. As yet the tropical vegetation has only conquered the edge of this flow, the inner portion being still nude. The author believes that so lately as some twenty-five years ago additions have been made to the flow, and as elsewhere water-vapour is still pouring out of rock-fissures, the volcano cannot be regarded as extinct.

From the gap in the crater wall the ground stretches down to the plain of lakes, which again suggests ice-action in its hummocky surface and valleys of erosion. The origin of this plain is to be sought in the eruptive phenomena which destroyed the crater wall and caused masses of mud and débris to deploy upon the low ground. In irregularly shaped basins on the surface so formed fourteen lakes lie, the largest having an area of about four square kilometres. The greatest depth obtained in this was 38 metres. The lakes are fed by streams running down from the hills, and are all saline. In spite of this they contain hippopotami and are frequented by many birds, suggesting the presence of fish, though this was not demonstrated.

On the highest part of the plain of lakes rain-forest occurs, but elsewhere the vegetation has the usual steppe characters, its uniformity only broken by the line of luxuriant wood which marks the course of the perennial streams.

To the south-east of Meru the grass steppe, which is here rich in streams, is the home of the Masai and their herds. The Masai rear especially cattle, which furnish them with all the necessities of life, but also sheep, goats, and asses. In contrast with the nomad Masai of the steppe region, the more fertile and better-watered tract which intervenes between the rain-forest and the plain on the south and east is inhabited by tribes practising agriculture. Of these the Wameru, which are most nearly related to the Wadshagga of Kilimanjaro, have been longest settled, and brought with them the use of the hoe and artificial irrigation. Certain of the pure Masai, however, owing to a great loss of cattle by rinderpest towards the close of last century, have betaken themselves to tilling the ground. With the help of irrigation the ground produces in abundance all the crops dear to the negro—bananas, peas and beans, maize, sweet

potatoes, manioc, and so forth, and there are good prospects for the further development of this region.

America.

The Mt. Pelée Obelisk.—We have spoken here from time to time of the great obelisk of rock which for a time crowned Mt. Pelée, and have also reviewed Professor Heilprin's book on the subject, so that our readers may be interested in a new article by that author in the *National Geographic Magazine* for August. The article records a fourth journey made by Professor Heilprin in the February of this year, for the purpose of studying the ruins of the obelisk, which now lies for the most part in shattered fragments, covering up much of what was before the ancient crater basin of the Étang Sec, and of the domed mass which has been constructed nearly centrally over the floor of this basin. The fragments are of varied size, ranging from diameters of 2 to 3 feet to those of 20 to 30 feet. In the early part of the present year, when the visit was made, the volcano, despite reports to the contrary, was wholly passive, and permitted a visit to the crater and dome. · The paper is illustrated by some very fine figures, illustrating not only the condition of the obelisk at the last visit, but its condition at the time of its fullest development—the contrast of the figures being very marked. As regards the disputed question of the origin of the obelisk, little further evidence was obtained, but Professor Heilprin considers that what he saw confirms his own opinion, that the obelisk was merely an ancient volcanic plug, lifted bodily from its position by the new volcanic stresses.

Australasia.

Irrigation in the Murrumbidgee Valley.—We have received from Dr. J. P. Thomson some particulars of a great irrigation scheme which the New South Wales Government proposes to carry out in the Murrumbidgee valley and the Lachlan, Namoi, and Gwydor basins. The first work which it is proposed to undertake is the construction of a dam and reservoir at Barren Jack. Barren Jack is about thirty miles from Bowning Railway Station on the Sydney to Melbourne line. The site is a deep gorge, where the river has cut through a solid ridge of granite. The sides of the gorge are between 300 feet and 400 feet high. The proposal embraces constructing a wall 200 feet in height right across the Murrumbidgee, thus damming the waters back for a distance of 40 miles. The reservoir will contain 1½ times more water than Sydney Harbour, and, in fact, will be little inferior to the great Nile dam. Much of the area of the actual dam site is now under cultivation as agricultural farms, and these will all have to be resumed. The full capacity of the reservoir will be 33,380,864,000 cubic feet, and the cost of the dam, including resumption of lands, is £758,000. The dam will first be built to a height of 120 feet, and its full height will be reached, it is anticipated, in seven years from the date of its commencement. The catchment area is 5000 square miles, embracing the whole of the

country drained by the head waters of the Murrumbidgee. One great feature of this scheme is that the waters will be brought to the land irrigated entirely by gravitation, and pumping will not be necessary. The new dam when constructed will be one of the greatest sights in the Commonwealth, and the New South Wales Government have selected a proposed site for the Federal capital right in its immediate neighbourhood. This site is known as Makoolma. Two or three alternative lines for a light railway have been surveyed to connect Bowning with the dam.

Polar.

The Wellman Polar Expedition.—The leader of this expedition, according to a communication from Hammerfest, dated August 28, abandoned his attempt to reach the Pole owing to the discovery of defects in the airship. The same communication states that Mr. Wellman intends to build a fresh airship with a view to making a new attempt on the Pole next year. The balloon-house and other plant erected by the party are to be left for next year's work in charge of a small wintering party, and the intention is that the new balloon shall arrive at Spitzbergen next May. The attempt to communicate with Hammerfest by wireless telegraphy proved, it is stated, a complete failure.

The Amundsen Polar Expedition.—According to a Reuter's telegram, received at Copenhagen on September 3 from Nome, Alaska, the *Gjöa*, the vessel of Captain Amundsen's Expedition, has arrived at that point on her homeward voyage. This means that the north-west passage has been completely navigated, though this was virtually accomplished when the *Gjöa* reached King Point last September (cf. this *Magazine*, vol. xxii., p. 41). It will be recollected that, in the first instance, Captain Amundsen hoped to reach San Francisco in the autumn of 1905, but owing to the early onset of winter he was obliged to go into winter quarters at King Point on September 3, 1905. The last news received was dated December, 1905, and it was stated then that Captain Amundsen intended to circumnavigate the Arctic regions. This was apparently, however, an error, for it is clear that the original intention to return *viâ* San Francisco and Cape Horn is being carried out. Full details of the wintering and of the subsequent journey will doubtless now be soon available.

General.

Volcanoes and Radioactivity.—In the *Popular Science Monthly* for June, Major C. E. Dutton discusses the question of the possible relation between volcanic eruptions and radioactivity, and gives it as his opinion that eruptions are caused by a development of heat resulting from radioactivity in limited tracts at a depth of one to three—or at most not more than four—miles from the surface, which is sometimes sufficient to melt the rocks affected by it. The melting is gradual, and when a

sufficient quantity of rock is melted, the water which it contains becomes explosive, and usually suffices to break through the covering, constituting an eruption. When all the lava is erupted, and the reservoir exhausted, it closes up for a time. If the heat continues to be generated, more lava is melted, and in due time another eruption occurs. The process may be repeated again and again many times, or it may even occur only once. Again, the volcanic matter may fail altogether to erupt at the surface, although all the process of preparation is gone through. This view thus offers an explanation for the repetitive character of volcanic eruptions. According to it the internal reservoir has no permanent existence as such, and contains no liquid eruptible contents until a portion of the strata is acted upon by some source of heat, and is liquefied, thus forming a temporary reservoir, whose contents are discharged at the surface, when a period of quiescence occurs until a fresh supply of lava is generated.

The details of the process of heat-generation may be surmised as follows. At a depth of two or three miles down in the crust of the earth radium is assumed to be generated. As it is generated it becomes transformed, giving off the so-called emanation, which is a gas of very high density and great penetrating power and diffusibility. Wherever this emanation penetrates the break-up of its particles generates heat, and the temperature rises in proportion to the amount of emanation which undergoes transformation in a given time, and falls in proportion to the rate at which it is conducted away. So long as the gain of heat exceeds the loss, so long will the temperature rise until it becomes sufficient to melt the rocks.

All volcanic rocks contain water, and those whose reservoirs are near the surface contain a large amount, while those which have a deeper origin contain less. The deeper lavas are hotter, and are erupted with less violence and in greater mass than the shallow ones, because it is the water which furnishes the explosive force.

Photography and Science.—We have received from the Permanent Commission of the International Congress of Photography a circular with accompanying papers relating to a proposed congress to be held at Marseilles during the present month (October). The congress is to be called "Congrès de la Documentation Photographique," and is to concern itself with all questions relating to the obtaining, preservation, and utilisation of photographs as scientific documents. The circular points out that invaluable as photography is as an aid in many branches of human knowledge, certain conditions must be fulfilled before a print can have the value of a document. These conditions relate in part to technical points and in part to points which vary according to the particular branch of knowledge dealt with. The object of the Congress is, therefore, to assemble together representatives of all the subjects concerned with a view to the full discussion of the various questions involved. It is hoped that one result may be the drawing up of a list of the existing collections of photographic documents, with notes indicating the nature, accessibility to the public, etc., of each collection.

Further particulars in regard to this somewhat ambitious scheme may be obtained on application to the Secretary, 51 Rue de Clichy, Paris.

Edinburgh Outlook Tower.—We have received from the Outlook Tower Committee a programme of lectures for the coming winter, as well as a Report on the work of last session. The programme is a very attractive one, and we note that Mr. R. N. Rudmose Brown, B.Sc., is to give his assistance to students of Geography during the winter. The report dwells with justifiable satisfaction on the success which attended the Geographical Exhibition held last July, some part of which remains permanently within the Tower.

Commercial Geography.

The Tunnelling of the Lötschberg.—It is announced that the legislature of the Canton of Berne has sanctioned tho project for the construction of a new trunk line which will pass through the Bernese Oberland, and connect with the Simplon route at Brigue. The scheme has been already mentioned here, and it is sufficient to point out that the new line, which tunnels through the Lötschberg, will afford a direct means of communication between northern Italy and north and north-west Switzerland. It is expected that the line will take about five and a half years to complete.

Utilisation of Water-Power in the Scottish Highlands.—The success of the aluminium works erected near the Falls of Foyers has, according to the *Times*, led to the formation of a scheme for the construction of similar works on a much more extensive scale at Kinlochleven, on the borders of Inverness-shire and Argyllshire. The place chosen has an abundant supply of cheap water power. The catchment basin has an area of 55 square miles, and the rainfall in the district is one of the heaviest in the British Isles. At an elevation of 1000 ft. above sea-level there is an excellent site for a reservoir in the centre of this basin. The reservoir will be about 7½ miles in length, with an average width of over half-a-mile, and when it is completed it will probably have the largest capacity of any artificial reservoir in Europe. It has been calculated that the approximate capacity of the reservoir will be something like 20,000 millions of gallons. The whole undertaking will cost over £500,000, and the period of construction is estimated at three years.

NEW BOOKS.

EUROPE.

Central Europe. By Joseph Partsch, Ph.D. London, Edinburgh, and Glasgow: Henry Frowde, 1905.

This learned and erudite volume now before us on Central Europe is one of the "Regions of the World" Series. From an introductory note by Dr. Partsch, the well-known Professor of Geography in the University of Breslau, we learn that his German manuscript was ready in 1899, but on being translated into

English it was found to be too long. The present work is a condensation by Mr. Reeves of Miss Black's translation of the original work, which will be published in due course in German. The greater part of the book deals with Germany and Austria-Hungary, but included in Central Europe are the Netherlands, Belgium, Switzerland, Montenegro, Servia, Roumania, and Bulgaria, "a superficial area of 626,000 square miles, inhabited by over 131 millions of human beings." It would be quite impossible within the limits of our space to present to our readers even a sketch of the contents of this exhaustive and most interesting work. The topography and orography of the region are described in considerable detail, and thoughtfully considered with reference to their effects on the climate, economic conditions, distribution, amalgamation, and political history of the people inhabiting the various countries which come under review. Dr. Partsch is apparently of opinion that the only serious enemies of Central Europe are France on the west and Russia on the east. The book was written before the late Russo-Japanese war, the lessons from which may perhaps have induced Dr. Partsch to modify some of the opinions he sets forth in his last chapter. As in the other volumes of this series this work is amply furnished with many useful diagrams, which very materially assist the reader in grasping the proportions of the statistics incidental to the great variety of subjects treated; the fact that the coloured orographical, geological, and ethnographical maps are the work of Mr. Bartholomew is a guarantee of their excellence. An exceedingly valuable feature of the book is the bibliography of works dealing with the various subjects touched upon, by means of which the student interested can continue and supplement his study of any particular subject.

British Canals: Is their Resuscitation Practicable? By Edwin A. Pratt. Pp. 159. London: John Murray, 1906. *Price* 2*s.* 6*d. net.*

Guide Officiel de la Navigation Intérieure, avec Carte itinéraire des Voies Navigables de la France. Dressé par les Soins du Ministère des Travaux Publics. Sixth Edition, revised and enlarged. Pp. 597. Paris: E. Bernard, 1903. *Price* 2*f.* 50*c.*

British Foreign Office Report on the projected Rhine-Neckar-Danube Ship Canal. Pp. 13. Published by Foreign Office, 1904. *Price* 3*d.*

While immense importance is attached in France and Germany to the upkeep and construction of canals, and to the utilisation of rivers as a means of cheap transport, the commercial use of British waterways has been long neglected, and the speedier, if more expensive, transport offered by railways has been preferred. The appointment of a Royal Commission on Canals and Waterways, which first sat to take evidence on 21st March 1906, shows that Government thinks the subject of sufficient importance to demand a searching inquiry; in order, in particular, to meet the complaint often made by British manufacturers and merchants that railway transit throughout Great Britain is so costly as to make it difficult for them to compete with foreign importers, whose goods are carried from distant ports to Britain by sea more cheaply than British goods are conveyed from one British town to another by railway.

On 5th July last an influential conference of representatives of Chambers of Commerce, manufacturers, and others in the Midlands interested in canal development, was held at Birmingham, and resolutions were passed to the effect "that a complete system of through communication by water should be provided between the centres of commercial, industrial, and agricultural importance and the sea; that it is desirable that canals and inland waterways should be acquired and

controlled by the Government or a public Trust, on which the Government should have the preponderating vote; and that in either case the interest and sinking fund on the capital expenditure should be guaranteed by the Government."

Mr. Pratt administers a sharp corrective to those enthusiasts who demand that our canals shall be so improved as to compete seriously with railways. The conclusions he arrives at are, shortly, as follows:—(1) Alike from a geographical, physical, and economic point of view, British and Continental canals cannot be fairly compared; (2) owing to the increasing demand for speedy delivery of small consignments, canal transport is no longer suitable for Britain; (3) although a few traders in the immediate neighbourhood of canals might benefit, the taxpayers generally would suffer; (4) the nationalisation or municipalisation of British canals is contrary to the private enterprise which originated railways; (5) owing to the physical obstacles and populous character of Britain, any general scheme of canal purchase or improvement would be extremely costly; (6) such a scheme, involving the expenditure of many millions, would affect our national finances; (7) as the cost would not be recouped by increased receipts from the canals, it would fall upon the community; (8) existing canals have been neither captured nor strangled by railway companies, which have often saved impecunious canals from extinction; (9) some useful canals offer traders all reasonable facilities, but could not bear the expense of great improvements without so increasing their rates as to make them prohibitive; (10) while navigable rivers might be improved, any general resuscitation of British canals is impracticable.

Mr. Pratt recommends that railways rather than canals should be improved, and maintains that if millions are to be spent they ought to be applied to reducing the obligations now cast upon railways, thus enabling them to reduce their rates to traders. He strongly advises the general trader to arrange to send, or to receive, larger consignments by railway, and he would then get much better terms from railway companies. Finally, he reminds agriculturists that the transport by railways, especially of perishable goods, is both quicker and cheaper than by canals.

Turning to Germany, Britain's great Continental rival, we find from the Foreign Office Report by Dr. Frederic Rose, H.M. Consul at Stuttgart, that "from 1877-97, the number of river and canal boats in Germany has increased from 17,653 to 22,564, an advance of 28 per cent.; the carrying capacity, however, has increased from 1,400,000 to 3,400,000, or about 143 per cent." Enormous expenditure is proposed for new or improved waterways, the estimated expenditure of such works in Germany being £14,013,750, in France £20,000,000, and in Austria-Hungary £31,000,000. Such figures stagger Mr. Pratt, but do not seem to weigh with our Continental competitors. He, however, maintains that, as "there is absolutely no basis for fair comparison between Continental and British conditions—whether commercial, geographical, or political—the question of reviving British canals must be judged and decided strictly from a British standpoint, and subject to the limitations of British policy, circumstances, and possibilities."

If Mr. Pratt's contention is correct, the fine official map of the navigable ways of France is rather an object of curiosity than of value to us. At the same time even he admits that something might be done to improve the navigation of our rivers. British rivers are often only silent, because unused, highways, whereas there does not appear to be a river in either France or Germany which is not a valuable waterway to the district which it traverses. When we remember that the most fertile agricultural tracts of a country are usually those in proximity to its rivers, bordered as the latter are by alluvial soil, and that great manufactures are frequently established near rivers in order to obtain water-power, as well as

water-carriage, we can understand why every effort should be made to increase the navigable possibilities of our rivers, even although, as in France and Germany, the national exchequer has to bear a considerable proportion of the cost.

Florence: Grant Allen's Historical Guides. New Edition. Revised and Enlarged by Mr. and Mrs. J. W. Cruickshank. Pp. 303. London : E. Grant Richards, 1906. *Price* 3*s.* 6*d.*

This book was first issued in 1897, and the fact that it has since been five times reprinted is sufficient testimony to its excellence. It does not compete with other guide-books in information about hotels, cab fares, etc., but devotes special attention to the art and the permanent attractions of the city. It is produced in handy form.

Europe. By W. Vere Mingard. "Geographical Handbooks." London and Edinburgh : T. C. and E. C. Jack. *Price* 6*d.*

This little handbook is well and abundantly illustrated both with figures and maps, although some of the relief maps seem to us of rather doubtful value, but otherwise has no very special features of interest.

ASIA.

Hinterland Moï. By Paul Patté. Paris : Plon-Nourrit et Cie., 1906.

The instructions given in January 1904 to M. Patté by the Governor of Cochin China were to investigate the hitherto unexplored country on the north-eastern frontier of Cochin China inhabited by the independent Mois, to enter into relations with their tribes, and to endeavour to get them to accept French protection. The expedition, which was well organised, and consisted of M. Patté as leader, a doctor, a French Annamite interpreter, an army sergeant and ten Annamite soldiers, an Annamite cavalry soldier, a Moï-Annamite interpreter, a cook, and a gardener, left Saigon and reached the Hinterland Moï in February 1904. In animated terms the author describes the progress of his mission, which lasted till June 1904, and appends the map which he made displaying his route, as well as a dictionary of the Moï language, and a vocabulary and anthropological observations by Dr. Neiss. He says the Hinterland Moï extends from the north of Cochin China to the south of the Laos territory, and from the east of Cambodia to the west of Annam. It has a luxuriant vegetation, with splendid forests, and its average altitude is from 160 to 200 metres. The temperature is equable, and ranges from 24° to 33° C. His mission found the climate a very healthy one. The Mois consist of varied racial types, and are a good height, with solid muscles and large feet. They inhabit groups of villages, each village representing as a rule one family. Their habitations are made of bamboo, and are generally on piles, and each village is protected by a palisade, sometimes double or triple. The love of liberty is characteristic of the Moï race, and the author found the people honest. With regard to religion, they have neither monuments nor traditions, and have no form of worship, but they pray to heaven. The volume contains many interesting illustrations.

Afghanistan. By Angus Hamilton. With a Map and numerous Illustrations. London : William Heinemann, 1906. *Price* 25*s. net.*

Mr. Hamilton is a pronounced and uncompromising Russophobist. He is also not a friendly critic of his own government. His position as such is, it may be admitted, not altogether an unreasonable one. From his standpoint, most of what

Great Britain has done in respect to Afghanistan previous to the advent of Lord Curzon of Kedleston (upon whom, almost alone of the various British statesmen and soldiers spoken of in the book, the author bestows unqualified commendation) has been unwise or been spoiled by subsequent unwisdom. That is an exaggerated and captious view; and there is little or no justification in fact or good taste for some of the critical remarks which he has permitted himself to record. Nevertheless, the problematic character of British policy and action in regard to the Asiatic countries lying immediately to the west of India during the last three-quarters of a century does stand in marked contrast to the unfaltering onward policy and action of Russia. Great Britain, a democratic power, innocent of conscious lust of conquest, has, at one time, been excited and swayed by political panic or moved by dread of commercial rivalry, at other times restrained by a prudence approaching timidity or lulled into letting the future take care of itself under a profession of confidence in the integrity of her rival or in the doctrine of free trade. She has occasionally seemed to pursue no settled policy, to adhere to no uniform, definitely conceived, plan of action, to have left unfinished that to which she had set her hand, to have been indifferent to the progress and protection of her trade. On the other hand, Russia, an autocratic power, has appeared to move steadily forward under a definite scheme of conquest, both military and commercial, guided by a powerful official and military caste which is troubled very little by scruples of conscience, and not at all by popular sentiment. In substance, Mr. Hamilton urges that, looking to the past, Great Britain ought to anticipate the continuance of the Russian policy, and ever be ready to confront it with similar steadfastness and strength. The check which Russia has met at the hands of the Japanese in the Far East is not likely in his opinion to extinguish or diminish her desire for expansion and annexation southward in Western Asia; rather the reverse. The book before us has evidently been issued partly under the influence of this view. The author has not taken into account events still more recent in Russia's history: her internal, civil, and military commotions, and the popular uprising against officialdom and autocracy. A great change—for a time, at least—in the internal policy of Russia, would probably follow such a displacement of the centre of authority as would result from the popularising of the Russian political and social system. But the outcome of her present disturbed condition is still in the womb of time; and all who are practically interested in the politics of the North-Western frontier of India and of Western Asia will do well to possess themselves of and consult Mr. Hamilton's volume.

For it is a compilation of cyclopædic character, more to be possessed and perused than to be read for pleasure. It sets forth no scheme of campaign of its own, although it criticises the campaigns of the past. But it is crammed with facts and statistics regarding the topography of the regions dealt with, their inhabitants, their productions and commerce, their recent and present political and social history and condition. Grace of style to attract the general reader there is none. But the statesman, the soldier, and the merchant who are concerned with Mid-Eastern affairs, will find it a most useful book of instruction and reference.

Of the seventeen chapters, six are devoted to Russian Turkestan; three to Herat, Kandahar, and Seistan; the rest to Afghanistan. Space is not available for an analysis of these various sections of the book. The nature of the Afghan of high degree and low, in its barbaric force, ruthlessness, greed, duplicity, and priest-ridden bigotry, remains much as it was. But it is encouraging to well-wishers of the country and of humanity to know that the comparative security and peace which Afghanistan has enjoyed under the Amir Abdul Rahman Khan

and his successor, the present Amir, as well perhaps as increased intercourse with the world outside through India and Russian Turkestan, have begun to act upon their manner of life. "It must not be forgotten," says our author, "that to-day Afghanistan reproduces the conditions of a settled country, possessing a population much more peaceful than were the inhabitants a generation ago. Moreover, through the penetrating associations of prosperity and through many years of peace, the warlike instincts of the tribes have become numbed, while their martial ardour has evaporated, requiring constant ameliorising of the conditions of service by way of stimulating their military zeal." Among a people of grit such as theirs, the gradual rise in the standard of comfort and manner of life can hardly fail in time to influence similarly their ideals of character and conduct.

In the appendices is tabulated a vast amount of topographical and other statistical information. They likewise contain extracts from treaties and official correspondence between the Governments of Great Britain, Russia, and Kabul; and a useful epitome of Afghan history from the time of Nadir Shah (A.D. 1747) to the present year.

As an important work in geography in its wide sense, the book merits special notice in this Magazine.

AFRICA.

Travels in the Interior Districts of Africa, performed in the Years 1795, 1796, *and* 1797. *With an Account of a subsequent Mission to that Country in* 1805. By Mungo Park, Surgeon. London: George Newnes. *Price* 3*s.* 6*d. net.*

This is a dainty little edition of this well-known classic, and many will be glad to renew their acquaintance with the explorer in so compact and handy a form.

POLAR.

No Man's Land. By Sir Martin Conway. Cambridge: at the University Press. 1906.

This is an introduction to the history of Spitsbergen. It tells its story from the first discovery of the coast by Barents in 1569 to the middle of the nineteenth century, when the scientific exploration of the island began in continuous earnest. The account of the rivalry of the Dutch and the English companies, which filled the main part of the seventeenth century, is hardly flattering to our national vanity. Individually the Dutch were the more accurate observers and the more enterprising and hardy fishermen, and they were vigorously supported by their Government. The Stuart Kings of England, on the other hand, sanctioned annexation, while they did not take measures to secure its validity by sending men-of-war to protect their whalers as the Dutch did. A most interesting account is given of Smeerenburg—Blubber Town—the great Dutch summer station and winter storehouse on Amsterdam Island, off the north-west of Spitsbergen, while it was still at the height of its greatness, towards the year 1650. After that date the whales more and more abandoned the coasts and bays of Spitsbergen, and Smeerenburg as a whaling base became valueless. A cairn—erected in 1878—and a handful of graves mark the spot where the seven "chambers" of the Netherlands had their factories and where hundreds of eager workers did so much for "the honour and prosperity of their country."

The eighteenth century saw trapping take the place of whaling and witnessed the beginning of Russian activity. It is to the Empress Katharine II. of Russia that belongs the honour of inaugurating the age of scientific exploration by the despatch of an Arctic Expedition in 1764 and 1765. As a nation we have more

reason to be proud of our scientific explorers, including as they do Bassington and Scoresby and Sir John Parry—whose attempt to reach the Pole by sledges was baffled by the same southward drift of the ice which afterwards aided Nansen,—and the distinguished writer of this book, Sir M. Conway.

The volume is meant primarily for the student, and its most valuable portions are the full bibliography from 1597 to 1902; the appendix on the cartography of Spitsbergen from 1598 to 1663; the identification of places known by different names; and the chronological list of the voyages to Spitsbergen during the last half century from 1847, when Captain Lund first sailed through Walter Thymen's Strait or Freeman's Strait between Barents' Island and Edge Island, to 1898, when the Swedish and Russian Governments despatched scientific missions to measure an arc of the meridian, a work which was successfully completed in 1900. But the book is also full of interest for the general reader, and the stories of fortitude and often of tragedy that illustrate the narrative are well and powerfully told.

GENERAL.

La Géographie à l'École et les Bases d'un Système rationnel d'enseignement. Par Jean Bertrand, Géographe. Pp. 122. Brussels: Larcier, 1906. *Price* 2 *fr.*

Although this brochure applies principally to the reform of the teaching of geography in Belgium, it contains advice of universal application. Thus, the author insists upon a course of geography being short and concise. The teacher should be allowed to teach as he pleases, and in the order which he considers the best, and he ought to use freely the method he judges the most rational. A teacher thus unshackled will reveal his powers and will teach his pupils infinitely better than if he were imprisoned in a narrow and Draconian programme. Again, the books employed ought to be the very best, such as those used in the French lycées written by Vidal de la Blache and Camena d'Almeida, with the atlas of Vidal de la Blache.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Liberia. By Sir Harry Johnston, G.C.M.G., K.C.B., D.Sc. With an Appendix on the Flora of Liberia. By Dr. Otto Stapf, F.L.S. With over 450 Illustrations reproduced from Drawings and Photographs by the Author and others, including 28 full-page Plates from the Author's Paintings reproduced in Colours. Also 22 Maps by Mr. J. W. Addison, Captain H. D. Pearson, R.E., Lieutenant E. W. Cox, R.E., and the Author. Demy 8vo. 2 volumes. Pp. xlii + 1183. *Price* 42*s. net.* London: Hutchinson and Co., 1906.

Ostasienfahrt. Erlebnisse und Beobachtungen eines Naturforschers in China, Japan, und Ceylon. Von Dr. Franz Doflein. Demy 8vo. Pp. xiii + 511. *Preis* M.13. Berlin: B. G. Teubner, 1906.

The Republic of Colombia: An Account of the Country, its People, its Institutions, and its Resources. By F. Loraine Petre. Demy 8vo. Pp. xii + 352. *Price* 8*s.* 6*d. net.* London: Edward Stanford, 1906.

A Historical Geography of the British Colonies. By C. P. Lucas, C.B. Vol. I. *The Mediterranean and Eastern Colonies.* By C. P. Lucas. Second edition. Revised and brought up to date by R. E. Stubbs, B.A. Cr. 8vo. Pp. viii + 304. *Price* 5*s.* Oxford: The Clarendon Press, 1906.

Discoveries and Explorations of the Century. By Charles G. D. Roberts, M.A. The Nineteenth Century Series. Cr. 8vo. Pp. xvi+529. *Price* 5*s.* Edinburgh: W. and R. Chambers, Limited, 1906.

The Dead Heart of Australia: A Journey around Lake Eyre in the Summer of 1901-1902, *with some Account of the Lake Eyre Basin and the Flowing Wells of Central Australia.* By J. W. Gregory, F.R.S., D.Sc. Demy 8vo. Pp. xvi+384. *Price* 16*s. net.* London: John Murray, 1906.

Die Vegetation der Erde. vii. *Die Pflanzenwelt von West-Australien Südlich des Wendekreises.* Von Dr. L. Diels. Large 8vo. Pp. xii+413. *Preis* M.36.

The Face of the Earth (Das Antlitz der Erde). By Eduardo Suess. Translated by Hertha B. C. Sollas, under the direction of W. J. Sollas. Volume II. Royal 8vo. Pp. vi+556. Oxford: Clarendon Press, 1906.

Documents Scientifiques de la Mission Saharienne, Mission Foureau-Lamy. Par F. Foureau. Parts II. and III. Paris: Masson et Cie., 1906.

My Experience of the Island of Cyprus. By B. Stewart. Cr. 8vo. Pp. xii+260. *Price* 6*s.* London: Skeffington and Son, 1906.

The Place-Names of Argyll. By H. Cameron Gillies, M.D., with a short Preface from his Grace the Duke of Argyll. Demy 8vo. Pp. xxvi+273. *Price* 6*s.* 6*d. net.* London: David Nutt, 1906.

A Concise Guide to the Town and University of Cambridge. By John Willis Clark, M.A. Cr. 8vo. Pp. xxiv+191. *Price* 1*s.* Cambridge: Macmillan and Bowes, 1906.

Also the following Reports, etc.:—

Catalogue of Map Room of the Royal Geographical Society, March 1881. Pp. xxiv+404. London: John Murray, 1882.

Presented by Mr. C. G. Cash, F.R.S.G.S.

A Catalogue of Manuscript and Printed Reports, Field Books, Memoirs, Maps, etc., of the Indian Surveys deposited in the Map-Room of the India Office. Pp. xxi+672. London: W. H. Allen and Co., 1878.

Presented by Mr. C. G. Cash, F.R.S.G.S.

Rules for the Transliteration of Place-Names occurring on Foreign Maps. Compiled in the Topographical Section, General Staff. By Alexander Knox, B.A. Pp. iv+83. *Price* 1*s.* London, 1906.

General Index to the First Twenty Volumes of the Geographical Journal, 1893-1902. Compiled by order of the Council. Pp. xxvii+629. London: Royal Geographical Society, 1906.

British Rainfall, 1905. Edited by Hugh Robert Mill. Forty-fifth Annual Volume. London: Edward Stanford, 1906.

Proceedings of the Royal Colonial Institute. Edited by the Secretary. Vol. xxxvii., 1905-1906. London: The Institute, 1906.

The Official Year Book of New South Wales, 1904-1905. By W. H. Hall. First Issue. Sydney: Statistician's Office, 1906.

Report of the Chief of the Weather Bureau, 1904-1905. Washington: U.S. Department of Agriculture, 1906.

Statistical Register of the Colony of the Cape of Good Hope for the Year 1905. Cape Town, 1906.

Report of the Progress of the Ordnance Survey to the 31*st March* 1906. *Price* 2*s.* 9*d.* London, 1906.

Administration Report on the Railways in India for the Year 1905. By the Railway Board. *Price* 2*s.* 8*d.* Simla, 1906.

Second Report of the Wellcome Research Laboratories at the Gordon Memorial

College, Khartoum. Andrew Balfour, M.D., B.Sc., F.R.C.P. Edin. Department of Education, Sudan Government, Khartoum, 1906.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th June 1906:—One-inch Map (third edition), printed in colours and folded in cover, or flat in sheets. *Airdrie.*—Sheet 31. Price—on paper 1s. 6d.; mounted on linen 2s.; mounted in sections, 2s. 6d.

It is notified that in future the price of all the ordinary series of small Scale Maps Mounted in Sections will be One Shilling more than the price of the same map on paper. In the case of special maps it may occasionally be necessary to vary these prices.

Six-inch and larger Scale Maps.—1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Caithness.*.—Sheet IV. 10. *Sutherland.*—Sheets VIII. 15; IX. 13, 14; X. 6, 7, 8, 10, 12; XVI. 8, 12; XVII. 3, 4, 5, 9; XVIII. 1, 5; LXXIX. 14; LXXXIX. 16; XC. 6, 10, 13; XCVIII. 13; CIX. 16; CX. 9 (10 and 11), 13, 14; CXI. 2, 3, 4, 12; CXII. 1, 2, 4, 5, 6, 7, 8 (10 and 9), 11; CXIII. 2, 5, 6.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st July 1906:—One-inch Map (third edition), printed in colours and folded in cover, or flat in sheets. *Maxwelltown.*—Sheet 9. *Ayr.*—Sheet 14 and part of Sheet 13. *Hamilton.*—Sheet 23. Price—on paper 1s. 6d.; mounted on linen 2s.; mounted in sections 2s. 6d. each.

Six-inch and larger Scale Maps.—1 : 2500 Scale Maps (Revised), with Houses ruled, and with Areas. Price 3s. each. *Caithness.*—Sheets I. 11, 15; II. 4, 8, 9 (11 and 7); III. 1; IIIA. 13; IV. (7 and 3), 11. *Sutherland.*—Sheets LXXIX. 15; XC. 2 (3 and 4), 7, 9; XCVIII. 3, 6 (7 and 11), 9, 10, 14; (XCVIII. 4 and XCIX. 1); CIII. 4; CIV. 1, 2, 3, 5, 6, 7, 11, 12, 15, 16; CV. 7, 8, 10, 11, 12, 13, 14; CVI. 1, 2, 5; CIX. 4, 8, 11, 12; CX. 1, 2, 5, 6; CXI. 8; CXII. 3, 12.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st August 1906:—Four miles to one inch, printed in colours and folded in cover, or flat in sheets. Sheets 1, 2, 3, 4, 10, 14. Price—on paper 1s.; mounted on linen 1s. 6d. each. These sheets complete the publication of the Four Mile Folded Map of Scotland.

One-inch Map (third edition), printed in colours and folded in cover, or flat in sheets. *Campbeltown.*—Sheet 12. Price—on paper 1s. 6d.; mounted on linen 2s.; mounted in sections 2s. 6d.

Six-inch and Larger Scale Maps (Six-inch Maps—Revised), full sheets, engraved, without contours. *Sutherland.*—Sheets 26, 27, 35, 36, 44, 45, 54, 60, 63, 65, 70, 72, 81, 82, 83, 84, 92, 93; Price 2s. 6d. each. Sheets 48, 80, 99A; Price 2s. each.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Caithness.*—Sheets I. 6, 7, 16; II. 10, 13, 14, 15, 16; III. 5 (13 and 9), 14 (15 and 11); IV. 8, 12, 13, 14, 15, 16; V. 9, 10, 12, 13, 14, 16; VI. 3, 4, 5, 8, 9,

11, 12, 13, 14, 15, 16; VII. 1, 2, 3, 4, 5, 7, 8, 9, 10; VIII. 1, 2, 9, 10, 14; IX. 4, 8; X. 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 15, 16; XI. 1, 2, 3, 4, 5, 6, 9, 10.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st July 1906:—Six-inch Maps, quarter sheets, uncoloured. Price 1s. 6d. each. *Edinburghshire.*—3 NW., 3 SW.; 4 NE.; 8 NW., 8 SE.; 13 SE. *Haddingtonshire.*—8 NE.

The following publications were issued from 1st to 31st August 1906:—Six-inch Maps, quarter sheets, uncoloured; Price 1s. 6d. each. *Edinburghshire.*—4 SW.; 4 SE.; 8 NE. *Haddingtonshire.*—8 SE.

BRITISH ISLANDS.—Geological Map based on the work of the Geological Survey. J. J. K. Teall, D.Sc., F.R.S., Director. 1906. Scale 1 : 1,584,000 or 25 miles to an inch. Price 2s. *Ordnance Survey Office, Southampton.*

This is a clear and effective map showing the general features of the solid geology of the country.

GLASGOW.—W. and A. K. Johnston's Plan of Glasgow. Scale 1 : 10,560 or 6 inches to a mile. 1906. Price 2s. mounted on cloth.

W. and A. K. Johnston, Ltd., Edinburgh.

A clearly engraved plan effectively printed in colours.

SCOTLAND.—Bartholomew's Reduced Survey Map, Sheet 5, Moffat, Hawick and Borders. New Edition. 1906. Price 1s. paper, 2s. mounted on cloth.

John Bartholomew and Co., Edinburgh.

BALATON-SEE.—Resultate der wissenschaftlichen Erforschung des Balatonsees. Mit der Unterstützung der hohen königl. ung. Ministerien für Ackerbau und für Cultus und Unterricht. Herausgegeben von der Balatonsee-Commission der Ung.-Geographischen Gesellschaft. *Topographisches und Geologisches Atlas. I. Theil.* Spezialkarte des Balatonsees und seiner Umgebung in vier Blättern entworfen von *Ludwig von Lóczy.* Maasstab 1 : 75,000. Ausgeführt im K. und K. Militär. Geographischen Institute, Wien.

Ed. Hölzel, Wien.

CONSTANTINOPLE ENVIRONS.—Scale 1 : 250,000 or about 4 miles to an inch. May 1906. Price 2s. 6d. *Topographical Section, General Staff, London.*

This is a section of a new War Office map of the Bosphorus and Dardanelles in nine sheets.

ASIA.

CHINA.—Province of Ché-Chiang (provisional issue). Scale 1 : 1,000,000 or about 16 miles to an inch. May 1906. Price 2s.

Province of Ssu-Chan (eastern sheet). Scale 1 : 1,000,000 or about 16 miles to an inch. 1906. Price 2s. 6d.

Topographical Section, General Staff, London.

HONG-KONG and the territory leased to Great Britain under the Convention between Great Britain and China in 1898. Scale 1 : 84,480 or three-quarters of an inch to a mile. *Topographical Section, General Staff, London.*

AMERICA.

UNITED STATES GEOLOGIC ATLAS.—Beaver and Ebensburg Folios (Pennsylvania), Clifton Folio (Arizona). Scale 1 : 62,500 or about 1 inch to a mile. Needle Mountains, Napesta, and Rico Folios (Colorado), Aladdin Folio (Wyoming),

Muscogee Folio (Indian Territory). Scale 1 : 125,000 or about half an inch to a mile. 1906. Price 25 cents. each folio.

United States Geological Survey, Washington, D.C.

Each of these folios contains several maps with descriptive text. There is always a topographic map, an areal geology map, and a sheet of structure sections; in some cases there is also an economic geology map, sheets of columnar sections, and reproductions of photo views illustrating special characteristics.

PANAMA.—Scale 1 : 1,000,000 or about 16 miles to an inch. May 1906. Price 2s.

Topographical Section, General Staff, London.

A map of the State of Panama showing the extent of the canal zone leased in perpetuity to the United States.

NEW ATLASES.

CLIMATOLOGICAL ATLAS OF INDIA, published by the authority of the Government of India under the direction of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India, and Director-General of Indian Observations. 120 Plates of Maps with Text. 1906. Price 36s. *John Bartholomew and Co., Edinburgh.*

This large and elaborate atlas exhibits almost every aspect of Indian Climatology, and may be said to summarise Sir John Eliot's life-long work in the Indian Meteorological Service. The atlas commences with a number of general maps illustrating orographical features, meteorological divisions, etc., then follow various series of monthly maps showing atmospheric pressure and winds, temperature and range of temperature, relative humidity and aqueous vapour pressure, clouds and rainfall, storm tracks, etc. Most of these maps represent averages of observations extending over a period of twenty-five years. Altogether the atlas represents a magnificent contribution to meteorological science. If all the states of the world could produce such records, a very great advance in Climatology would be achieved. The work has been engraved and printed at the Edinburgh Geographical Institute under the supervision of Mr. Bartholomew.

STANFORD'S OCTAVO ATLAS OF MODERN GEOGRAPHY.—Fifty coloured maps with an alphabetical list of names with their latitudes and longitudes. Third Edition. 1906. Price 25s. bound in half morocco.

Edward Stanford, London.

This is a new edition of a useful collection of maps for general reference purposes. Some of the plates are new, and the others appear to be carefully revised to date. The mapping of the British Empire receives special attention, but why Ceylon should be specially mapped on a scale five times larger than the crowded plains of India and even much larger than England, is difficult to imagine.

ATLAS OF THE WORLD'S COMMERCE.—A new series of maps with descriptive text and diagrams showing Products, Imports and Exports, Commercial Conditions and Economic Statistics of the Countries of the World. Compiled from the latest official returns at the Edinburgh Geographical Institute, and Edited by J. G. Bartholomew, F.R.G.S., etc. Complete in 22 parts. Part 5, Maps and Text illustrating Wool, Steel, and Coal. Part 6, Maps and Text illustrating Silk, Fur, Feathers, and Gold. Part 7, Maps and Text illustrating Silver, Lead, Petroleum, Asphalt, and Indiarubber. Part 8, Industrial and Commercial Maps of Canada, United States, South America, and West Indies. Part 9, Commercial Maps of Africa, North Atlantic Ocean, Australia and New Zealand. 1906. Price 6d. each part.

George Newnes, Limited, London.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

THE NEW ANGLO-FRENCH FRONTIER BETWEEN THE NIGER AND LAKE CHAD.

By Captain C. H. Foulkes, R.E.

(With Map and Illustrations.)

On the 29th of last May an agreement was finally arrived at between Great Britain and France in reference to the line of demarcation separating the respective territories of the two countries between the river Niger and Lake Chad, that is, between our own colony of Northern Nigeria and the French possessions in the Soudan. It will probably be remembered that this is not the first time that the boundary in question has been defined. By the Anglo-French agreement of August 1890 the frontier between the British and French spheres of influence was drawn from Say on the River Niger to Barrua on the western shore of Lake Chad "in such a manner as to comprise in the sphere of the Niger Company all that fairly belongs to the kingdom of Sokoto, the line to be determined by the Commissioners to be appointed."

As a matter of fact, this vague and unsatisfactory frontier was never "determined," and very different interpretations were given to it by British and French cartographers.

When the relative positions of the two countries in the Niger basin were under discussion in the years 1897-1898 a modification of the 1890 frontier was agreed to, and a Convention was signed in June 1898 after difficult and prolonged negotiations.

The modified frontier started a good deal lower down the Niger than the previous one had done (at Say), *i.e.*, at the mouth of a water-course called locally the Dallul Mauri. It ran along the median line of this watercourse for some way, and then followed the circumference of a circle of 100 miles radius with Sokoto as centre, after which it followed

certain lines of latitude for stated distances until it reached the western shore of Lake Chad.

It will be noticed that this frontier was a purely arbitrary one, and instead of following the natural features or the political divisions of the country, it followed a line which could only be determined on the spot by exact astronomical observations. Moreover, the precise limits of the spheres of influence of the two Powers were rendered still more uncertain owing to the fact that the position of the town of Sokoto had never

The market-place, Sokoto.

been accurately determined. As a matter of fact, no more precise line could at that time have been agreed upon owing to the scarcity of information available with regard to the region in question, as the latter had only rarely been visited by explorers.

But the principle of the agreement was this, that France was given a good route by which her possessions at Zinder and in the neighbourhood of Lake Chad could be conveniently reached from the Niger, and by which communication could be established between her Congolese territory and the French Soudan, while the integrity of the Sultanates of Sokoto, Katsena, Kano and Kukawa, which were recognised as having been placed under British protection, was respected.

However, when the French Government undertook the occupation of

the territory which had been consigned to it by the terms of the treaty, it was found that the only practicable route from the Niger to Zinder and Lake Chad (namely Say, Konni, Maradi, Zinder, Yo) lay almost entirely in British territory, whereas the French posts of Filingué, Tawa, Zinder, and N'Guigmi were separated from each other by wide waterless deserts.

Communication between these posts was prolonged for a considerable portion of each year by sinking a series of wells at intervals of about 15 kilometres along the route, but in the dry season even this water supply failed, and the permission of the N. Nigerian Government had to be sought for the passage of troops and convoys across British territory during the period when the only alternative route was closed. A certain amount of friction arose locally in consequence, and in order to terminate so irregular a situation a joint Commission (of which the present writer was a member) was appointed to survey and fix the 1898 frontier line.

This Survey, which extended along a line one thousand miles long, and which was spread over a considerable distance laterally in view of the possibility of further modifications of the frontier being made, lasted nearly two years, and proved to be an arduous task owing to the unhealthiness of the climate and the difficulties of transport; and, in addition, the Commissioners had to carry on their work with only a nominal escort, less than one hundred miles from Sokoto, which for some months after the commencement of the Survey was occupied by hostile armies of natives, who were eventually dispersed by a powerful military expedition from the south.

Before the completion of this Survey Great Britain and France had brought to a happy conclusion certain important negotiations which culminated in the Convention of April 1904, one article of which dealt with a modification of the 1898 frontier running between the Niger and Lake Chad.

By this time both Governments had precise information of the nature of the country through which the greater part of the old frontier ran: and in order to secure to France the route which she desired a theoretical modification of the frontier was agreed upon, whereby the position of the line was moved considerably to the south.

At the same time a special clause was added which stipulated that this new frontier should only be definitely fixed by a joint Commission on the spot, when the political divisions of the country could be studied, and the integrity of the lands belonging to the various tribes would be respected as far as possible. In accordance with this clause delegates appointed by the two Governments discussed the situation in October 1905, and again in April 1906, with the result that a final frontier line was agreed upon—still further to the south—which a Joint Commission has just been appointed to delimit.

The British Commissioner is Major O'Shee, R.E., who was recently entrusted with the demarcation of the Anglo-Portuguese frontier between Rhodesia and Mozambique, and the French Commissioner is Captain Tilho, one of the signatories in London of the new frontier,

and a member of the previous Niger-Chad Boundary Commission of 1902-1904.

The two Commissions meet on the Niger in December of this year, and in all probability they will have completed their work soon after the middle of 1907, as a very accurate geographical survey already exists of the whole of the country through which the frontier passes, and their chief work will consist in settling the conflicting claims of the various chiefs to villages and fields on or near the line. In brief, as the result of an extensive concession of territory to France, for which no doubt an equivalent has been received elsewhere, or, in goodwill, the French Government has secured a practical route at all seasons of the year from the Niger to Lake Chad *viâ* Bengu, Bei-Bei, Matankari, Konni, Chiberi, Maradi, Zinder, Gurselik, Kabi, and Yo. The frontier does not exactly follow this route, as if it did, a portion of the territory of the chiefs of Maradi and Zinder would fall within the British sphere.

Roughly speaking, the present frontier marks the southern limits of the Sahara. The territories traversed by it had remained unexplored from the time of Dr. Barth's travels in the early fifties until about the time of the Anglo-French agreement of 1890, since when a number of French expeditions have been despatched to this region.

On our side, owing to the hostility of the Emirs of Sokoto and Kano, the frontier districts have not been visited, excepting for a reconnaissance, which was carried out by Major Merrick, R.A., in 1902, and which extended from the Niger along the "Sokoto arc" as far as Maradi. The country itself is poor, sparsely inhabited, and practically waterless. Deep sandy tracks wind through the dreariest expanses of thorn bush. The latter is stunted (as are the few existing trees) and powdered with a deposit of fine grey sand. Only near the villages are there any signs of cultivation: these consist chiefly of fields of guinea corn and a kind of millet, with here and there small patches of the cotton and indigo plants. In certain of the villages, situated in neighbourhoods in which water is found near the surface of the ground, onions also are grown.

During the dry weather, *i.e.*, for one half of each year, the climate is comparatively healthy, excepting on the banks of the Niger and on the marshes bordering Lake Chad: but in the rains it is very unhealthy and is similar to that experienced throughout the year on the Coast. In the moist heat Europeans become anæmic and enervated, and almost invariably suffer from malarial fever, and often from dysentery.

In November the dry season commences, and the temperature rarely rises above 95° F. (in the shade) during the day, while at night it falls as low as 40° F.

The air is impregnated with fine dust borne by the Harmattan, an extremely dry wind, and owing to the haze thus caused it is often difficult to see objects only a quarter of a mile away, while at night the stars are often completely hidden, and even the moon is sometimes invisible.

In about March the temperature rises rapidly. The thermometer

sometimes registers a maximum of 115° F. in the day, while at night the temperature is often as high as 95° F.

May is the month of tornadoes, and these are often of extreme violence, though ample warning is always given of their approach. The air is breathless for an hour or two previously, and the heat of the sun is almost intolerable. Presently there is a stampede of natives running to the nearest shelter, and a mile or two away (generally to the north-east) the storm can be distinctly seen sweeping across the plain, its progress being marked by bushes and trees bent over almost horizontally by the wind, and a long line of churned-up sand. For a quarter of an hour the wind howls and plays havoc with every loose article left out in the open, and fine sand penetrates even "water-tight" tin cases. Later on, these sand storms are invariably and immediately followed by rain, which falls very heavily for a few minutes.

Following the tornado season come the regular rains, in which thunderstorms are frequent. These often provide a magnificent spectacle, and sometimes hang directly overhead for an hour at a time. Deafening peals of thunder occur almost simultaneously with the most vivid lightning flashes, and rain falls in torrents. The sandy soil becomes quickly saturated with water, and river beds which a few minutes previously had consisted of loose sand, feet deep, are now swirling streams capable of carrying a man off his feet and depositing him in some distant flooded hollow.

As the season advances the rainstorms decrease in violence and give place to steady downpours: the rainfall becomes smaller and smaller, and the dry season gradually sets in. Pools of water (tubkis) which had formed in shallow depressions of the ground—the temporary haunts of numbers of wild geese and duck—disappear, and no surface water is to be seen anywhere. Even the larger rivers, which throughout the whole of the wet season ran two or three feet deep, dry up, and the only water obtainable is from deep wells in or near the villages. These latter are usually found five or ten miles apart, but sometimes they are separated by forty or fifty miles of waterless "bush."

The great majority of the inhabitants of these regions are Haussas, who are subdivided into tribes according to the districts in which they live.

Generally speaking, the suffix "awa" added to the name of the district gives the tribal name of the inhabitants. Thus the people of Gober and its neighbourhood are known as Goberawa, though as a matter of fact this ancient town is more generally known at the present time as Chiberi.

The Mauris and Arewas, the inhabitants of the Dallul Mauri, are pagan Haussas of warlike disposition. Their villages are surrounded by strong timber stockades, outside which a ditch is often found as an additional defence. The stockades are a formidable obstacle in themselves, and they are sometimes rendered still more impenetrable by thorn bushes which are planted in the interstices.

Groups of villages, only two or three years ago, ranged themselves

in active hostility against other groups: battles, massacres and slave-raiding expeditions were frequent events, and no one ventured far outside the vicinity of his stockade unarmed. These tribesmen are armed with bows and arrows, spears and swords, all of local manufacture. The arrows are barbed, and are often poisoned, preparations from certain roots and berries being used for this purpose. The action of the poison is often very rapid, death ensuing only a few minutes after the infliction of the wound: but occasionally, when the poison has not been freshly applied, little harm results from it.

The Maradi river during the rains.

A certain number of the warriors, depending on the wealth of their chief, are mounted on horseback, and a cavalry charge delivered by two or three hundred of these savages is a stirring sight. On a given signal, made by beat of drum, the whole of the horsemen dash forward at top speed, regardless of order and spurring furiously, their white garments floating in the wind: above the thunder of hoofs and the tumult of hoarse cries, the clashing of their spears on their enormous white shields can be plainly distinguished, while close behind follows a dense rolling cloud of dust.

The poorest of the houses in the villages consist, roof and walls, of

woven grass matting supported on a framework of sticks; the chiefs' houses have mud walls, and, very rarely, flat mud roofs provided with a primitive system of rain-water drainage. Further east, towards Konni and Maradi, nearly all the houses are built of mud throughout, while the towns are encircled with strongly-built mud walls, ten to forty feet high,

Arewa warriors.

with a deep ditch outside. A few of the towns even have a double ditch separated by a ridge, whilst the walls of Kano are loopholed near the top and the gateways are built in deep recesses cleverly constructed and elaborately prepared for defence. Throughout the country the chiefs and a few of the headmen in most of the towns are Fulanis, and wandering Fulani herdsmen are sometimes met with in the bush driving their cattle from one grazing spot to another. There are a few scattered communities of Asbenawa (the "masked Tuaregs" of the desert) resid-

ing in the country: one of these is to be found at Azarori, and their king, an important chief, is called the Mullul. Another Asbenawa settlement is established just to the north of Chiberi. These Tuaregs are divided into two classes: the upper class is nomadic for the most part, and in the wet season members of it retire into the desert with their camels (which cannot live through the rains), and barter their loads of guinea corn for the salt and dates which they obtain from the inhabitants of the oases. The lower class of the Tuaregs resides in the villages and

The great wall of Kano.

occupies itself in cattle breeding and in agricultural pursuits. The Tuaregs possess a magnificent military spirit, and they excel in the use of the spear and sword at close quarters. In addition to the ordinary long crusader sword of the country, they generally wear on the left arm a second and shorter sword, the scabbard of which is provided with a leather bracelet which is sewn to it near the hilt, and through which the wrist is passed. Descended originally from fair-skinned forefathers (even now they boast that they are white men) they have mixed considerably with the black peoples whom they have conquered from time to time; but they still retain the aquiline features of their ancestors

with their chivalry and pride of race. At the time that the present writer was in that neighbourhood, the Mullul, previously referred to, collected some bands of fighting men, and, in settlement of an old quarrel, attacked and sacked the fortified town of Chara, putting nearly all its inhabitants and those of the surrounding villages to the sword. This, too, in spite of the fact that the Chara people were greatly superior in numbers and were fully prepared. About a thousand of them fell in this battle, while the Tuaregs lost but five or six men. A French officer who

A Tuareg from Asben.

was in command of the military post of Buza at that time, reported having seen one of the victims lying dead on the ground with his head cut clean through like a melon by a Tuareg sword. The Tuaregs prize the women of their own race greatly, and are often influenced by their advice in council.

Eastwards of Maradi, and between it and Lake Chad, the country is divided into the three great sultanates of Zinder, Kano and Kukawa. The two former are said to be by far the most populous and fertile districts between the Middle Niger and the Nile; and in addition to the vast supplies of guinea corn and millet that are raised, great quantities of potatoes, cotton, tobacco, tomatoes, indigo, melons

and dates are also produced. Cattle, sheep, goats, and donkeys are found in considerable numbers, while weaving is one of the principal occupations of the inhabitants. The rise of the principality of Zinder has been a most remarkable and rapid one. Only sixty or seventy years ago it was a small tributary dependency of the Sheikh of Bornu. A few successful wars enabled it to not only declare its independency, but also to extend its suzerainty over all the neighbouring states, until at the present time it has an area about equal to that of Greece, while its population numbers half a million. It owes its prosperity largely to the fact that until recently vast caravans from Tripoli and other Mediterranean ports passed through it on their way to Kano. But the trade that was carried on in this manner in former years is now being rapidly killed by the establishment of commercial stations on the Benue and Lower Niger; and in all probability when the proposed railway from the coast to Kano is eventually constructed, Zinder will lose still more of its prosperity in favour of Kano. Kano is by far the most important and populous city of the Central and Western Soudan, of which it is also the commercial centre. Its vast and picturesque market-place is one of the sights of Africa; but a detailed description would not be in place here, besides which it has been fully described by travellers in the last year or two.

Eastward of Machena, and to the north of the river Yo, the country is flat and almost bare of vegetation and cultivation. Gurselik is the chief town and the inhabitants extract large quantities of salt from the ground by a process of infiltration. The salt industry is a most remunerative one, and in exchange for the product all the necessaries of life are obtained. In some of the villages in the district, however, a certain amount of land is cultivated, the people resorting to the extraction of salt in the dry season only. Further east, and extending almost to Lake Chad itself, is the desert of Mir, which is 120 miles wide, and in which there are few water-holes, known only to hunters, and but one oasis. Between the river Yo and Kukawa only fifteen years ago a number of flourishing towns existed, but the whole country has since then been devastated by Rabah and his followers, and now presents a melancholy aspect. Kukawa itself did not escape, and this beautiful and great city became a mass of blackened ruins. However, now that peace has been re-established in these regions there are signs of returning prosperity, and the capital of Bornu is already in course of being rebuilt.

Lake Chad itself has an area of 7000 square miles, and it is equal in extent to the combined areas of Caithness, Sutherland, Ross and Cromarty, Nairn, Elgin and Banff. Of the lake itself no very definite survey has yet been made, nor indeed, owing to the marshy nature of the country in its vicinity, and the extent to which its area is affected by floods, has it any very definite boundaries. This uncertainty of outline is more marked on its east than on its west side, and a large portion of the area of the lake is occupied by shallow lagoons and dried-up canals connecting them. There are only two open sheets of water of any considerable extent, and these are separated from one another,

and are the basins into which the rivers Yo and Shari empty themselves. Judging from the accounts of early explorers it would appear that the lake has lost one-third of its area by evaporation in the course of the last fifty years. Possibly the Harmattan wind which prevails in this part of Africa for one-half of the year is responsible for the decreasing area of the lake, partly by reason of the evaporation caused by its extreme dryness, and partly also owing to the quantities of sand—especially on the east side—which it deposits, and which form islands of constantly increasing size. The waters of the lake are shallow, averaging between two and six feet in depth, and in no place has a sounding of more than twelve feet been yet obtained. The lake contains quantities of fish, and there are also numbers of hippopotami, alligators and turtles. Game abounds in the vicinity, elephants, giraffe, rhinoceros, pigs and antelopes all being found in considerable numbers. The islands of the lake are well populated, though many of the inhabitants of the archipelago have been probably driven there temporarily by slave-raiding marauders. They carry on a large trade with the people of Bornu in dried fish, and also in cattle in which they are especially rich. Until recently these herds were the objects of frequent raids on the part of the Tubus, the inhabitants of the country to the north of the lake: but the latter did not always enjoy the fruit of their rapacity in peace, as they in their turn sometimes fell victims to the Tuaregs, the "kings of the desert."

ZIMBABWE:

A Re-statement of its Problem, and a Solution.

By A. H. Harley.

The hypotheses of Science have long been taken up into our intellectual life; its methods are now being applied to all our interests. Out upon Nature, in upon himself turns man's inquisitive spirit accumulating a limitless material, but meaningless till submitted to the classification that passes with us for knowledge. Fain would he regulate destinies: not so elusive are the secrets of the eternity behind him, before his imagination the world may yet stand in the first blush of its youth. But into the effort to rehumanise the impersonal past, and to read a history in fossil or fragment must be adopted those methods of "organised common sense" that relate and classify, and treat only the irrational as inexplicable. Their application hails the advent of specialism, before which a science breaks up into departments, and one man's authority is particularised.

Half a century ago Archæology was defined by Sir Charles Newton as "the science of all the human past." Since then the range has been found too wide. The historian for his researches has appropriated the literary documents from the mass of materials, but more than enough remains, and few students will dissent if, with Mr. Hogarth, we define

Archæology as "the science of the treatment of the material remains of the human past" (Preface to *Authority and Archæology*). The volume now before us, *Mediæval Rhodesia*,[1] by Mr. David Randall-Maciver, is in intensest sympathy with this definition, and if to the end the author refers to documents it is not by way of appeal from his material, but that he may bring life into his picture.

Only some fifteen years ago the world was told a tale of East Africa, how a round thousand years before the present era certain sons of Arabia had visited and toiled in Rhodesia. It touched us gently in the manner of ancient tale or Oriental. Like a robe of fine-spun it settled, mantling itself easily round us. A few with theories or other qualms chose to be dissociate; their attitude seems justified by this recent publication.

Zimbabwe, chief of Rhodesia's numerous ruins, was known to the Portuguese settlers in East Africa, but stood neglected or forgotten for near three hundred years. The credit of rediscovery rests with Adam Renders, who pitched tent in its neighbourhood in 1868; Dr. Karl Mauch gave the first information. Since then many have visited the ruins, but the two memorable years are those when the British Association took action, for by them are dated the two theories of their origin. In 1891 Mr. Theodore Bent, aided by a grant from the Association, made explorations at Zimbabwe, and published his conclusions in his *Ruined Cities of Mashonaland*. In 1905, when the Association arranged to visit South Africa, Mr. Maciver was asked to precede them and report on the ruins. Between April and September he worked on several sites, including Zimbabwe. The results of his exploration are detailed in *Mediæval Rhodesia*, of which his paper in *The Geographical Journal*, April 1906, is a comprehensive survey.

Whatever unrest the finds may have occasioned certain experts, the ordinary reader must have regarded the utter absence of inscriptions as at least a misfortune for the older theory. This ill-luck does not haunt that which is now proposed, for, when the identity of the people has been established, we shall see that an inscription might have been a misfortune.

The author had opportunity to visit seven sites,—Niekerk, Inyanga, and Umtali in the north-east of Rhodesia; Nanatali, Dhlo Dhlo, Khami, to the south-west in Matabeleland; and Zimbabwe, near Victoria. From the evidence he has gathered we would show the homogeneity of their buildings. Zimbabwe, he claims, can be translated into terms of the others; its "Temple" can be "explained as a combination of the developed form of Inyanga hill-fort with such a stone-fenced kraal as Nanatali" (p. 84).

A.—Homogeneity of the Buildings.

The buildings of Niekerk and Inyanga are reducible to three types: forts, pit-dwellings, and ordinary dwellings.

[1] *Mediæval Rhodesia*, by David Randall-Maciver, M.A. Illustrated. London: Macmillan and Co., 1906. *Price* 20*s. net*.

Forts.—None of the forts visited is the exact reproduction of its neighbour. As in our own architecture the site influences the form, exigencies the minutiæ. The prevailing shape may be termed elliptical —under a certain reserve, for symmetry was sacrificed to expedience. The contour of the ground was studied; a boulder could support a wall, and it was a coign of advantage to defender or assailant as it was within or without. This remark anent the large eastern fort at Inyanga is memorable for its own sake, and for a light it throws on the buildings on all the sites:—"There is no uniform design; the building was evidently carried out by many hands working simultaneously at different points, and the resulting irregularities were compromised according to the inspiration of the moment. Thus, a wall was begun of a given thickness, but, on being carried to a certain point, came into collision with another wall, whereupon its thickness was reduced to meet the necessities of the new case" (p. 6). The walls are of rough construction, of undressed stone, and round the inner side runs a banquette. In the interior notice is attracted by rings of stone at Inyanga, and circular platforms of clay at Niekerk, whose use will be explained later.

The Niekerk fort, which is specially referred to in the thesis of the "Temple's" explanation, merits a detailed description. It shows a slight development of form; in shape elliptical, it is divided into halves by a curved wall across its lesser axis. Within the southern half is a built enclosure "standing free of the outer wall in such a way as to leave a passage about two metres wide between the two, suggesting the origin of the well-known 'Parallel Passage' at Zimbabwe." There are several circular platforms in the northern half. The stone-laying is rough, but "much dexterity has been shown in dovetailing the living rocks, one of which towers up six metres, into the circuit of the rampart."

Pit-dwellings.—These dwellings are almost invariably situated on a hillside or an incline. The builders, having selected a suitable site, raised a massive platform. The surface was kept horizontal; the frontage towards the hill-foot was therefore the steepest. Within this platform is a pit, and from it there leads a narrow underground passage emerging into the open uphill. The pit, then, is raised not sunk, and with its passage is on the natural level.

The question of the purpose of the pit has drawn the several conjectures of cattle-sheds, slave-pits, grain-stores, etc. Our author contends that the importance of the pit and the passage have been emphasised to a misconception; they are but parts of a complex whole. Be it noticed that the surface is occupied with circular enclosures or with clay platforms, such as were observed in the forts. Evidence was forthcoming that the enclosures and platforms had been the scenes of huts, with stakes and thatching in the art of modern Kaffir erections. The hypothesis of a recent Kaffir settlement might readily suggest itself, but for the fact that there is no evidence of modern natives having squatted in Niekerk, and "that the same characteristics are extended over so wide an area." These constructions on the hillside were miniature citadels, and the pit was a place of refuge. The occupants of the huts may frequently have

been called on to defend themselves, and, in the event of a strong invasion, the defenders would be able to turn all their energies to resistance, undistracted by anxiety for their women and children who would be sheltered in the pit; and, in the last resort, one warrior at the entrance to the passage could refuse admittance to a host. The proximity of the citadels to forts adds weight to the evidence from their common possession of enclosures and platforms that both types were contemporaneous.

Ordinary dwellings.—The feeling of security, derived probably from the neighbourhood of a fort, effected changes in the pit-dwelling, gradually more radical, till the original cannot be traced in the expressionless final form. But stages could be observed which proved the evolution of this new type.

The majority of the buildings at Umtali are dwelling-places, merely girdle-walls with the now familiar rings of stones. There are no forts or miniature citadels. There are no lines of defence on the hills.

Lines of Defence.—Another reason for thinking that the inhabitants of Niekerk lived in constant fear of attack is found in a new evidence of their preparedness to withstand the most formidable foe in "one of the vastest series of entrenchment lines anywhere in the world," "built walls, row on row, covering plateau and hill alike." A system emerges; there are nine or ten well-defined hills; around the bottom of each runs a boundary wall, behind which and at a few metres interval series of thirty to fifty or more girdle-walls encircle each hill to the village on the summit. For their explanation the cultivation-terraces of South Arabia have been urged. Professor Keane illustrates (*Great Zimbabwe*, Introduction, p. 34) by excerpts from two narratives the close correspondence, but where a careful synthesis is preferred to a partial observation the following statement will receive due acknowledgment: "These intrenchments have been erroneously described as irrigation terraces by those who have only seen the lower series and the bottoms of the hills. . . . The view that they were made for purposes of cultivation would be untenable in any case. There is not enough water to irrigate, the walls are too high, except close down to the valleys, to allow of crops growing between them, nor is there any indication that soil has washed out from them. At the most a few small crops may have grown between the lower tiers, but the immediate connection of the walls with the pit-dwellings and forts is quite unmistakable" (p. 28).

(*a*) That the object of the northern buildings was to secure the indwellers against invasions is one position which may be asserted; the evidence suffices for a second, the desired protection was from a Northern foe, for, whereas at Umtali there are no fortifications, between it and Inyanga the pit-dwellings begin, and nearer Inyanga the hill-forts; farther north Niekerk is similarly defended, and rendered practically impregnable by a system of intrenching extending over every hill within view northwards, and intermittently probably to Nani. From the region of the Zambesi came fearsome marauders, but met at Niekerk and Inyanga a worthy foe, a people that knew the arts of war and of peace; that discerned the possibilities of their ground, and made safety doubly sure; that engineered with skill their watercourses, and attained

excellences in dry-building. Was this an African people? The Kaffir preserves at all events the model of their huts; and nothing has been observed that is not African.

"The ruins of north and west explain Zimbabwe"; we look to the west therefore for new features. The buildings on these three sites are of one type, and that not unknown to us—elliptical enclosures, girt by a wall of undressed stone, and occupied with circular platforms. The platforms here and at Zimbabwe are of granite-cement, but they filled the same function as those of clay, they provided the flooring of huts. The type of building is, then, the northern fort. But, whether paradoxical or not, it is true that the problem of these western buildings is suggested by the two known factors, the wall and the platforms; for the former is not built consistently throughout, and the platforms hold various relations to it. Are there in these facts signs of different periods and builders? The following references are to Dhlo Dhlo and Nanatali in particular, but not exclusively, for Khami possesses a "minute similarity of structural detail" with the others.

On the west and north-west quarter of the citadel at Dhlo Dhlo the main wall rises in three well-built tiers, and is variously decorated with patterns of herring-bone, chessboard, chevron, and cord. "These patterns are all characteristically African, and found in every corner of the Continent, north, south, east, and west" (*The Geographical Journal*, p. 328). Flush with the top of the third tier is a platform, which shares with another on the east side of the dividing northern entrance the distinction of being highest in the whole enclosure. The cement floor of the citadel might have been raised to a common level, but it has not, and for another reason than the incline of the site,—this platform was held in the highest honour, and picked out to every eye by the ornamentation. We may turn to Nanatali for confirmation. Here the similarly tiered and ornamented wall extends from a platform on the west to a point a little beyond the north entrance, which leads directly and exclusively to a platform in the centre of the fort. Its intention therefore is to mark off these two platforms as of special note. But there are other features which would incline one to this view; the platforms are on the same level; they are the highest in the enclosure; that on the west is built in the line of the main wall, that in the centre is an actual hub with radiating walls to the girdle-wall.

Do the materials yield a clue to the secret of this distinction? Our author finds several grounds for conjecture that a witch-doctor occupied the hut on the western platform. By means of the private path from his dwelling along the inner side of the tiered wall he would have ready access to the chief; for the commanding eminence of the central platform seems explicable only on the ground that its hut housed a chief in becoming retirement from his followers in the southern and plainer part. Possibly there would be support for this conjecture in a remark of Mr. Hall: "Before the British occupation the witch-doctors practically ruled the people, and their influence in many known instances was greater than that of dynastic chiefs" (*Great Zimbabwe*, p. 97). The decoration therefore picked out sacred or venerated precincts.

The outer-wall is not consistent throughout its length. At Nanatali it varies in thickness from 1·70 to 4·0 metres. At Dhlo Dhlo a girdle-wall is carried round from the north-east till it meets the tiered wall on the west, but "this girdle-wall and the enclosures and rings against it are quite undistinguishable in style from the rough buildings of Inyanga, of the Niekerk Ruins, and Umtali." One might be disposed to assign them to another period than that of the better-built ornamented wall, but that they complete the defences, and are therefore essential to the plan of fortification; they contain besides "exactly the same cement platforms that are found within the citadel." There is no case for the hypothesis of different periods, and the buildings of this district are but developments of the northern fort.

(*b*) The evidence from these sites may be thus summed up: the buildings in the west are but a development and elaboration of the rude northern fort; the builders' wealth of design has been spent on the important quarter in comparative indifference to the remainder.

In these later days the ruins near Victoria have appropriated the name Zimbabwe. The received translation is "houses of stone," and in its original use the term denoted the residence of any chief. The ruins, massive and majestic, but wanting the beauty and symmetry of Nanatali, comprise three groups:—the Acropolis, the Valley Ruins, and "The Elliptical Temple." The last is the best known. Mr. Bent explored it, and the designation is his. This latest explorer has found reasons for substituting "The Great Kraal." The "Temple," he maintains, reproduces on a vaster scale the plan of the fort described at Niekerk; it resolves itself into two nearly equal divisions; a parallel passage runs along the line of the east wall; there are dwelling-platforms within. Further, "the northern division exhibits the same scheme of arrangement as that seen in its most perfect form at Nanatali" (p. 71). The façade of the main wall on the east and south-east carries a decorative pattern, and we are not now surprised to find that the quarter behind was held in signal estimation; it is here that the large cone stands. The greater part of the southern division was occupied by platforms. "Elliptical Temple" is therefore a misnomer; more properly might the stately ruins appropriate Bent's unsupported interpretation of Zimbabwe, "Here is the Great Kraal."

One point requires present notice—the main wall, it has been said, does not belong in its entirety to one period; it exhibits an "ancient" and an "old." The west wall provides the test case. It is admittedly slighter than the east wall, for example, inferior in its construction, and shows a misfit where it joins the northern; further, near this joint there is a foundation of a wall which would have continued the main on a truer curve (cf. Preface, *Great Zimbabwe*, by R. N. Hall). These facts are formidable, rather were so, for by this time we have ceased to regard Zimbabwe as an isolated unit, and we translate it into terms of the known, viz. meaner parts yielded to the more conspicuous in workmanship and elaboration. If the west wall is unsymmetrical and shows a misfit, that was stated as a characteristic of, not as a charge against the companion forts in the north. The supernumerary foundation-wall is

not without its parallel, for the northern and the eastern forts at Inyanga show similar foundations as lines of intrenchments or ruins of outworks.

Zimbabwe, for the hurried examination of the Acropolis and the Valley Ruins presented no new problems, has its fellows; its veriest detail is a sympathy. It possesses in its Cone one peculiar feature, or idea rather, for in a piece of dry masonry of such a height the batter-back, which has resulted in the conical shape, may have been found necessary. With the western trio Zimbabwe developed a grandeur and a grace that the rougher buildings of the north could not boast, but it worked upon a derived form. "The Temple can be completely explained as a combination of the developed form of Inyanga hill-fort with such a stone-fenced kraal as Nanatali."

From the facts before us we can deduce the relative dating of the ruins. The strongest measures of defence were taken in the region of the Zambesi. Niekerk and Inyanga show so similar fortifications that they can be assigned to the same period. These measures relax at every advance southwards, till the rather expressionless Umtali is reached. There is every probability that this site falls into line with Niekerk and Inyanga, for the weakening system of fortification is perished, and it repeats the type of the ordinary dwelling at Niekerk. From its composition of fort and decorative design Zimbabwe connects with north and west. Last in succession, and none claiming a considerable seniority, come Nanatali, Dhlo Dhlo, and Khami, children of an age when the fiercer art began shading off into the gentler. It was in the North the pioneers evolved their style of fort, in the South they turned their art to its adornment.

B.—Dating.

Some of the sites have been occupied by modern natives; an object, therefore, fixed on at random is no argument for anything; it is a curiosity till its relation to something known has been defined. We know that the platforms, whether of clay or cement, served to support huts of similar construction to modern Kaffir; we have yet to see the relation of the platforms to the walls. They have been built without the main wall, but in this position their date is indefinite; into its line, so that they are of one age; within it, in such a manner that "at Dhlo Dhlo the whole interior of the Acropolis, and at Zimbabwe the whole interior of all the buildings, have been filled with these constructions of rubble and cement, which fit as closely to the sides of the stone walls as water frozen into a glass" (*Geographical Journal*, p. 331). They are numerous in all the sites, and we have not realised their importance. The outer walls, meagre, massive, or majestic, were built by men, not by sportsmen, by a people for the protection of life and home. Anything, therefore, found in or beneath these floors, is contemporary with the main building.

There is no occasion to enumerate the various finds; many of the implements are of a kind in current use; the pottery, coloured or incised,

and hand-made, is quite African. The most valuable for our purpose are imported objects of known date discovered in unquestionable positions. The three Northern sites yield nothing foreign, save one fragment from Umtali of stoneware with a "celadon glaze which dates it from the thirteenth to the fifteenth centuries A.D." In the interior of Dhlo Dhlo a platform was selected for excavation, "and yet it was here, in the unbroken cement floor of a dwelling demonstrably as old as any in the whole settlement, that the Nankin china was found," "two pieces of flowered blue-and-white china," which are certainly not earlier than the sixteenth century A.D.

There may still be a feeling that, since Mr. Hall does not claim a date in the remote Himyaritic period for Dhlo Dhlo and Inyanga, Zimbabwe's pretensions to stratification may be valid. The area of this controversy narrows itself down to Enclosure 15, the lowest part of the "Temple." "From an archæological point of view this enclosure is one of the most interesting compartments in the temple," writes Mr. Hall, "for here are to be seen several layers of floor of a succession of occupiers, each for a long period of time" (*Great Zimbabwe*, p. 263). In one of the floors he found among other objects Arabian glass and Nankin china. The theory of stratification is now strenuously opposed. In the first place, Mr. Hall did not dig to bed-rock—was, indeed, two metres short of it. This intervening space was occupied by a layer of sand next the rock, another of sand and ashes, and immediately beneath his lowest floor one of rubble and cement. The bottom of the layer of sand and ashes contained objects such as had been discovered three metres higher. In the second place, all above the lowest floor is a homogeneous whole. Strata there are, but not chronological; they are due to the method of building. "When one bed of soft cement had been laid, wood was put upon it and a fire lighted to harden it, so that distinct lines of charcoal can be seen at all depths. . . . All manner of débris that might be lying about, potsherds, pebbles, and broken stuff of every description was thrown in to make a stiffer concrete" (p. 66). A further proof of this unity there is in wooden baulks, which were set vertically in the soft cement to hold it together, and whose remains still penetrate several layers.

This is the lowest part in the "Temple," and there is none older, for the depth of some of the finds is lower than the foundation-wall. Possibly it contains in itself signs of a previous settlement; the layer of sand and ashes may once have been a rubbish-heap, but it is too thin to have been of long accumulation, and contains the same objects as were found at a much higher level; it may merely have been laid as a bed for the foundation of rubble. The foreign glass and china determine the date of the enclosure and hence of the "Temple."

From Render's Ruins in the Valley comes a piece of Oriental faience belonging to a vase of which several fragments have been previously recovered. This piece bears a Persian inscription, "date month Shawwal." Four Persian scholars set it down as not earlier than the fifteenth century, while Mr. Read of the British Museum assigns it to the fourteenth, or possibly the thirteenth, in which case this "faience

and the Arabic glass would be the earliest of all the objects ever obtained from Zimbabwe" (p. 80).

We have now considerable guarantee of accuracy in dating the structures. The absence of imported articles from Niekerk and Inyanga constitutes a difficulty, but it is open to us to work back from Zimbabwe. Its buildings were raised no earlier than the fourteenth century, however much later, and the hypothetical older settlement can be but a century or two remoter. Unto this last would approximate Inyanga and Niekerk, with Umtali mediate. The sixteenth or perhaps the seventeenth would see the erection of the kraals in the West.

C.—Symbols, Etc.

The Cone.—A quite plausible explanation of its shape has been suggested; another is proposed for its significance, and based on the fact that "the great kraal" has single possession. It may have symbolised the chief's majesty, and the humbler cone close by the lesser presence of his principal wife, his heir, or Vizier. Such explanation, "though there may not be an exact parallel for it, is yet in perfect consonance with African custom," and, if valid, completes the unseating of the theory that the cone was the embodiment of Phallic worship.

Phalli.—Phallic emblems have been found in Zimbabwe, but it is "rash" to suppose that it was therefore the centre of a Worship; they may have had merely ceremonial functions. Further, "it is misleading to describe as a 'Phallic worship' those rites in which an anthropomorphic deity of any kind appears"; and could such a worship be proved, it need not own to a Semitic origin, for 'if there is any evidence of actual worship of the phallus in any part of the world, it is to be found amongst the most typical of all negroes, viz. those of the West Coast of Africa" (p. 100, Notes).

The Zodiac, discovered near Zimbabwe, and upon which so much has been based, is treated with scant ceremony; this "wooden platter, carved with bungled figures of the zodiac . . . belongs to a class quite well known to ethnographers as coming from the West Coast of Africa. It is, of course, not Oriental, but Kaffir work influenced by European" (p. 93, Notes).

Quite fearlessly are these supposed points of Oriental contact examined, and their cumulative evidence for the older argument is rejected. The negro built and manufactured to his own design; the Semite was only partner in the barter of wares.

D.—Tradition and Historical Situation.

Traditions of the origin of the ruins are wanting amongst the natives. The only source preserved to us is in the accounts of the Portuguese settlers (most conveniently consulted in Theal's *Records of South-Eastern Africa*) who reached Sofala in 1505 and established a trading-station. The references to stone ruins in the interior are few in number, and the internal evidence is not very satisfactory. Two belonging to the

middle of the sixteenth century deal at some length with a building, apparently Zimbabwe, but both confess to oral inspiration. All the narratives agree, however, that the interior was under rule of a great chief with the dynastic title of Monomotapa. His capital in the sixteenth century was Zimbabwe, and he administered his state through captains, who dwelt in similar fortresses. There is no mention of foreign dominance, but witness that the ruler was of the same negro stock as his people. By the seventeenth century the chief's kraal had been transferred to the region of the Zambesi. Popular dissension threatened his sovereignty from within and the Portuguese from without. The title is not in evidence after the early years of the nineteenth century.

Historical situation.—The argument has been kept within the defined range of Archæology; the material remains have shown the character of the impress made on them. Platform and building are African, the work of a "negro or negroid race of African stock, coming . . . possibly from north of the Zambesi" (p. 37). Reaching Niekerk about the fourteenth century A.D., this semi-barbaric people applied itself to its defence. In course of time its projections extended southwards, to Umtali in the fifteenth century probably, and to Zimbabwe, which was at the zenith of its importance in the first years of the advent of the Portuguese. Then followed in the sixteenth or seventeenth the fortress-kralls of the West, but possibly not till the "Zimbabwe" had begun to decline, and had lost its title to the new capital by the Zambesi. The conclusion of the tale is yet to find. The same storms, the efforts to withstand whose violence have been the object of our study, may at last have proved this people's undoing. "Some one of those terrible waves of devastating conquerors which have swept over South Africa periodically as long as we have any knowledge of its history, may have blotted the inhabitants off the face of the earth and left the city to fall into ruins" (p. 86). The veil of Romance has been lifted, but it has revealed to us a pulsing form. Dimensions are as large as before, only they are those of an African people.

ON ISLAND FLORAS.[1]

THE volume named below adds one more to the many contributions which have island floras as their main objective. Mr. Guppy professes only to follow in the steps of men like Bentham, Hooker, Hemsley, Hildebrand, Seemann, Schimper, and others who have endeavoured to explain the peculiarities of island floras. The "observations" have been made in many islands in the Pacific, and during sojourns in Java, South America, and the Mediterranean. During recent years the trend of Mr. Guppy's work has been evident in a series of papers mainly contributed to scientific societies, and including a paper to this Magazine

1 *Observations of a Naturalist in the Pacific between* 1896 *and* 1899. By H. B. Guppy, M.B., F.R.S.E. London: Macmillan and Co., 1906. *Price* 21*s.*

on the "Distribution of Aquatic Plants and Animals" (*Scottish Geographical Magazine*, January 1893). The present book has therefore the advantages which result from matured thought, and is a study belonging to that period of geographical investigation which follows the period of discovery. The results will disappoint the reader who expects a geographical romance of the vivid type, a panorama in which descriptions of landscape, animals, man and his customs pass in rapid review. The book, however, is an important contribution to plant geography, and is already a standard work. The objects of the author might, it is suggested, be more easily grasped if a short account of the existing views on the origin of island floras had found a place in the opening pages. Such a summary would not only enable the non-specialist reader to pick up the threads of the author's arguments, but would demonstrate how valuable Mr. Guppy's observations are. The small number of illustrations is also noteworthy in a book published at the present time when these are so much used in scientific works. Wealth of illustration may be used to make up for poverty of facts, yet it is possible to err in an opposite direction.

The flora of oceanic islands is of interest because they have a large proportion of endemic species, and even genera, which occur on a single island or group of islands, and are not found in any other place. The problem of how this condition arose is one of deep interest, because within its scope lie the consideration of plant-dispersal, the influence of isolation on the evolution of new species, and the influence of environment on plant-form, while behind all is the greater problem of continental plant-distribution. One school may try to explain the origin of island floras through the dispersal of fruits or seeds blown by the winds, drifted by ocean currents, or carried by birds. Another considers that the plants have migrated along land-connections with adjacent islands or continents. A third attaches much importance to the moulding influences of climate or soil of the station where the plant occurs; in other words, supposing some individuals of a species became located on a mountain top and others on the sea-coast, and maintained their life there, in time two species might arise differing in habit and structure, the one fitted for the mountain life, the other for the sea-coast. Mr. Guppy's observations have led him to the conclusions that no one of these agencies by itself, nor the combined effect of all taken together, is sufficient to explain the distribution of plants on the islands of the Pacific. "It is something a great deal more than all three," and the object of this book is to indicate something of the "great deal more."

Some of the best chapters in this book are the records on the floating capacity of seeds and fruits. The reader is transported to a Pacific island, and "after having been over the island gathering specimens of all the seeds and fruits, we return to our abode on the beach. But we are puzzled where to begin. The problem presents itself as a tangled skein. . . . In our trouble we look around us; and at that moment we see a number of floating seeds and fruits carried by the current past the beach. We place all our seeds and fruits in a bucket of sea-water, and notice that many of them sink at once." After the experiment thus

begun has gone on for some months: "We then remark to our surprise that nearly all of the floating seeds and fruits belong to coast plants, those of the inland plants, which indeed make up the great bulk of the flora, having, as a rule, little or no buoyancy." The further fact is also revealed that in a genus comprising both coast species and inland species, only the coast species possess buoyant seeds or seed-vessels." During a period of residence in Britain, Mr. Guppy tested about three hundred British species in regard to seed-buoyancy: the table of results given in the appendix will be a recognised standard for British botanists. The proportion of native flowering plants with buoyant seeds or seed-vessels is much lower than in the case of Pacific plants, but the majority are those of plants found either on our sea-coast or on the margin of streams or ponds. The investigation shows, however, that only a minority (about one-third) of our coast plants have buoyant seeds; thus the fruits of the Sea Holly (*Eryngium*) and the Sea Aster (*A. tripolium*) sink very soon, while the Sea Convovulus (*C. Soldanella*) and Sea Purslane (*Arenaria peploides*) floated for over a year. In other words, although the majority of the coast-plants of a Pacific island might have been brought there by ocean currents, only a few of the British coast-plants can have arrived in this way. Similarly the presence of only a certain number of plants occurring along the margin of fresh-water can be accounted for by buoyant seeds, and most of the submerged water-plants have non-buoyant seeds. The author in seeking for an explanation, says: "It is the fitness or unfitness of a plant for living in dry situations that primarily determines the station. If a xerophilous plant has a buoyant seed or seed-vessel it finds its way ultimately to the coast; if it is hygrophilous and its seeds or fruits can float, then it is finally established on the side of a pond or river." This argument, and another, that "Nature has located the plants with buoyant seed or seed-vessels at the sea-coast" (in the case of Pacific plants), are both open to the objection that they pre-suppose a plant to be "created" with a buoyant seed or a xerophilous nature, and that no account is taken of the possibility that these characters of buoyancy of seed and xerophily may have been acquired by adaptation. Another statement, that, "the plants now frequenting wet stations may often be regarded as the remains of an age when moist conditions for plant-life prevailed," also suggests a forlorn hope thrown out without supports.

The characteristic features of the coast-floras, and the relations between coast species and inland species, are introduced by a comparison between the three great groups of Pacific islands which have as their centres Fiji, Tahiti, and Hawaii respectively. The most complete coast flora is that of Fiji, where the mangrove formation occurs in estuaries and tidal flats, while the rocky coasts and beaches are occupied by a beach formation, and intermediate formations occur between. The plants of the beach formation extend inland, because they have "the xerophilous organisation," and the plains and other scantily vegetated areas offer a station. The Tahitian strand-flora lacks the mangroves and many plants which grow in or near this formation. Since many of the missing plants have buoyant seeds, they can reach the coasts, but their absence

is attributed to the lack of the necessary conditions, namely those found in a mangrove swamp. The Hawaiian group also lacks the mangrove formation, and the beach formation is scantily represented. These differences in the three groups of islands lead to a discussion of the currents of the Pacific, and the germinative capacity of floating seeds. The author agrees with most observers that the plants dispersed by currents are mainly of Indo-Malayan origin, but, this being so, they have extended eastward to Tahiti against the South Equatorial current, except from January to March, when the North-west Monsoon prevails in the Pacific. The Hawaiian Islands are isolated by distance and by the arrangement of the currents, hence the author favours the view that they may have received plants from America. The absence of the mangrove from Tahiti and Hawaii is due to the failure of the seedlings to arrive there in a living condition, and the author's experiments show that in warm currents many seeds either germinate prematurely or sink. Thus it appears that there are many barriers to seed-dispersal by ocean currents, and that this process by itself would not suffice to stock an island with plants.

Additional evidence is brought forward in this book on the structure of floating seeds and fruits, the main facts of which are described in Schimper's *Plant Geography*. Buoyancy is attained either by hollow cavities or by layers of light tissue, which so reduce the specific gravity of the seeds or seed-vessels that they float. Schimper also shows that the seeds of certain coast-species are provided with means for floating, while in inland species of the same genus this provision is absent. This was considered an excellent case of adaptation; but Mr. Guppy will have none of it: "he contends that it is not proved that the relatively great development of buoyant tissues in the case of littoral plants is the effect of adaptation; and that if the selecting process had been confined to sorting out the xerophilous plants with buoyant seeds or fruits and to placing them at the coast, the same contrast would have been produced," "Nature, it is held, has never made any provision for dispersal by currents, the buoyancy of seeds and fruits being, as concerns the currents, a purely accidental quality." An example supporting this view is *Entada scandens*, a widely distributed tropical plant both inland and on the coast, and found in ocean drift from the Arctic to the Coral Sea; its floating power is due to an internal cavity, but at least 50 per cent. of the seeds sink in sea-water because this cavity is not large enough to float the seed.

The problems connected with the origin of the inland flora are also discussed by comparing the Fijian, Tahitian, and Hawaiian floras. The largest islands of the Hawaiian and Fijian groups are much larger than any in the Tahitian archipelago. Fiji rarely attains to altitudes above 4000 feet, a small area in Tahiti exceeds 5000 feet, whereas in Hawaii there are three mountain masses of large area which reach from 10,000 to 14,000 feet. On these altitudes snow lies during winter, and the summer is cold, the mean annual temperature being about 36° F. There is a gradual transition downwards to the lower levels, where the climatic conditions are fairly similar in the three groups of islands:

Fiji, however, has the more humid climate, with a rainfall of 80 to 100 inches at the coast, increasing to 300 inches per annum on its mountains. Only the lower zone of Hawaii, below 4000 feet, is comparable in regard to flora with Fiji and Tahiti; the mountain flora of Hawaii is scantily represented in the other groups, and one has to look to New Zealand and the Antarctic, as well as other temperate or elevated tropical floras for equivalents. The eight chapters of this book, which deal with the colonisation of the interior of Pacific islands by plants, are filled with details too numerous for a general review. The author considers that the plants arrived during successive eras of time. Dr. Treub has shown in recent times that the first plants to appear in the island of Krakatoa, which was denuded of all vegetation during the eruption in 1883, were wind-borne spores of ferns, algae, etc. while later came coast plants, and these distributed by birds. This first era is called by Mr. Guppy the Age of Ferns. During this period wind-borne spores and seeds arrived and peopled the islands, and, as the wind currents have been continuous ever since, the stream of colonists must still continue. It is interesting to notice that Fiji and Tahiti, which are nearest the Indo-Malayan mainland, have still the largest number of ferns and their allies, while the more isolated group of Hawaii has a large proportion of endemic ferns. These endemic species are regarded as having arrived during an early period of the Age of Ferns, and their existence is dependent on the large area of elevated land. The second era is that of flowering plants belonging to genera which are endemic or peculiar to each group of islands, "since it is implied that they have descended from the earliest phanerogams that established themselves in the group." Hawaii again claims the largest number of endemic genera, and this is connected with its greater isolation. The conspicuousness of genera of Compositæ and Lobeliaceæ in the Pacific has led the author to designate this as the Age of Compositæ. Evidence is given that a certain number of these endemic genera came from America, and that birds were the chief agents of transport. The arrival of these genera is placed during the Tertiary Period when the Fijian area was almost submerged. In this way the absence of many of these endemic genera from the Fijian group is explained. Fiji, however, has its own peculiarities in the presence of certain coniferæ (*Dammara*, *Podocarpus*, and *Dacrydium*) which are absent from Hawaii and Tahiti. The author regards these as belonging to an Age of Coniferæ which prevailed in the Fijian group during the Mesozoic Period, when the Hawaiian and Tahitian groups of islands did not exist, therefore this age preceded that of the Compositæ. During the Tertiary submergence of the Fijian area suggested above, these coniferæ are regarded as having maintained their hold on a few of the mountain-peaks which were not submerged. A later period in the flora of the Pacific islands is thus defined: "The following epoch, which ends only with the arrival of man, is characterised by the genera found outside the group; and here different degrees of antiquity are indicated according as the genus is represented wholly or in part by peculiar species, or contains only species found in other regions." The large mountain mass of Hawaii is specially rich in endemic species, many of them belonging to

genera characteristic of the Antarctic or New Zealand, with some representatives of American affinity; more than half, however, belong to genera (e.g. *Ranunculus*, *Rubus*, *Vaccinium*, and *Plantago*) found in all temperate parts of the world, and in the temperate zone of tropical mountains.

In a chapter on Seed Dispersal and Geological Time, a useful summary of the author's views is given. The glacial period of the Northern Hemisphere is here placed subsequent to the age of Coniferæ and that of Compositæ, and its effect was to drive the tropical flora into "the tropical Western Pacific," only to be set free after the cold period had passed away. Then came the later epoch of Indo-Malayan plants. The glacial period is also invoked to explain the shifting of the source of Hawaiian plants from America to Asia. Another agency is emphasised thus: "The suspension to a great extent of the agencies of plant-dispersal in the Pacific in later times is connected with a general principle affecting the whole plant-world. With the secular drying up of the globe the differentiation of climate, bird, and plant have gone on together, the range of the bird being mainly controlled by the climate, and the range of the plant being largely dependent on the bird."

Two chapters are devoted to the mangroves, with their peculiar viviparous seeds, which germinate on the tree, the seedling falling to root at once in the mud below, or to be carried off by the rising tide. This vivipary is generally regarded as a kind of *cul-de-sac*, or specialised form representing the other extreme from seeds which fall from the parent in an immature condition unfit to germinate until they have lain on the ground for some time. Mr. Guppy does not regard vivipary as a highly evolved process, but as a remnant of a condition which existed commonly in early plants at a time when the earth's atmosphere was humid and warm. This hypothesis was referred to by the President of the Section of Botany at the British Association (York, 1906), who drew attention to the absence of any trace of vivipary in any fossil seeds known at present.

These notes on an important work will indicate that while the author regards himself "mainly as a plotter of detail, rather than a delineator of great designs," he has suggested the outline of several great designs. It is possible not to accept all the general principles which the author regards as underlying the origin of the present flora of the islands of the Pacific, but this does not depreciate the value of his "Observations." The position is thus stated in the preface: "Yet the final object of a naturalist would be but a sorry one if his aim were only to write a treatise and append his name to it. His personal faith lies behind all his work; and no one can pursue a long line of study of the world around him without rising from his task with some convictions gained and some convictions lost."

RECENT STUDIES OF THE NORTH AMERICAN INDIANS.[1]

We have recently received the handsome volume named below, which includes the Director's Report for the year indicated, and also a long and beautifully illustrated paper on the Mythology, Esoteric Societies and Ceremonies of the Zuñi Indians, by Mrs. Stevenson. Although for the most part the Report is naturally chiefly interesting to the ethnologist, who will find in it a large amount of valuable matter, yet there is also much to interest the geographer. For example, the Director's Report contains the following account of aboriginal economics.

"It is well known," he says, "that aboriginal America gave the world corn, the potato, certain beans and squashes, tobacco, two varieties of cotton, and the domestic turkey; it is not so well known that the native tribes utilised various other natural resources which might well be introduced into the dietary and commerce of Caucasian peoples; and still less is it realised that various prepared foods habitually used by the Indians are of unsurpassed excellence, for while succotash and hominy have come into general use in the United States, the far superior pinole, tamale, and pemmican are only locally used by whites, and many other desirable dishes are entirely neglected. When the Bureau was instituted it was a common impression that the aborigines were mere huntsmen and fishermen whose habits were in the highest degree vicious and improvident; but as the human activities were defined and the aboriginal industries were adopted it became more and more evident that many of the tribes were essentially agricultural, and that all subsisted in much larger degree than is commonly supposed on the produce of the soil. As researches progressed the importance of various aboriginal food sources neglected by the Anglo-Saxon was realised, and at the same time it became clear that the people of the States might learn much from the red man concerning the simpler agricultural methods and the ways of bringing plants and animals under cultivation or domestication. The success of the native in utilising natural resources is well illustrated in the arid region comprising that portion of the country still unsettled. The traveller over an important railway for a few miles west of El Paso to a few miles east of San Bernardino traverses a zone supporting a Caucasian population of some 20,000, with perhaps half as many Indians; the same zone abounds in ruins of aboriginal dwellings, temples, acequias and reservoirs, attesting a population fully ten times greater during the agricultural period antedating the long-continued and disastrous Apache wars. It is highly significant that the least-populated arid districts in the south-west of the States are those yielding the most abundant evidences of a numerous population during prehistoric times. A specific example may be found in Arivaca valley, Arizona, with a present popula-

[1] *Twenty-third Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution*, 1901-1902. J. W. Powell, Director. Washington: Government Printing Office. 1904.

tion of less than a hundred, where one of seven prehistoric villages within the valley comprises ruins of more than 120 dwellings, with temple, corral, stadium, and plazas, evidently representing a population of fully 600 for the village, and 3000 to 5000 for the valley. Although the depopulation began in the prehistoric age, through wars still in progress at the time of discovery, the historic period has witnessed a part of the change: for it cannot be doubted that Cabeça de Vaca, Coronado, Alarcon, and their followers saw within the zone between western Texas and eastern California a population twice or thrice the aggregate now subsisting within it, and this despite modern multiplication of industries connected with mining, grazing, and transportation. The success of the aboriginal husbandman in this region was partly due to a system of irrigation so satisfactory that modern farmers often profit by the prehistoric ditches; yet his chief advantages grew out of a more economical adjustment between labour and produce, including crops now neglected.

"Among the neglected crop plants are various cacti (locally known as saguaro, pitahaya, nopal, saguesa, etc.) whose fruits sufficed to support the entire native population for some two months of each year, though they are rarely utilised by white settlers. These cacti are products of the desert *par excellence*, adjusted to their habitat during geologic ages; and they give promise that, unless exterminated by vandalism, they will some day yield to intelligent cultivation a valuable resource for the arid districts of the States. The researches concerning aboriginal food sources have been coupled with other studies in native economics, including those pertaining to textiles used for clothing, birch-bark used for canoes and habitations, the making of baskets, etc. In most cases the immediate aim was to record the primitive customs and crafts as a contribution to a knowledge of a passing race, but the investigations have reached the stage of yielding useful lessons to the superior race.

"As announced in recent reports, productive studies of the beginning of agriculture and zooculture have been conducted. During the fiscal year a memoir on Wild Rice, by Dr. Jenks, was published, with a view to directing attention to a natural resource giving promise of value to modern agriculture; Dr. Russell spent the greater part of a year in a critical study of a typical tribe of the arid region (the Pima Indians), and has prepared a memoir on their industries for early publication; a systematic investigation of the birch-bark industries of the aborigines was also taken up by Dr. Jenks; and Dr. Fewkes devoted a part of the year to a special study of the aboriginal economy of Porto Rico, with particular reference to the artifacts and customs still extant, and giving promise of future value to that newly acquired territory. . . .

"The special investigation undertaken by Dr. Russell among the Pima Indians covered aboriginal industries developed in and adapted to the arid region. Here, as in Porto Rico, local types of habitation have resulted from the climatic and local conditions. The primal house type is a small circular structure of cactus or reeds, roofed with earth, the whole supported by an inner framework of poles. This type is varied according to available materials, the grass house and the house

of cactus (okitilla stems or saguaro ribs) being closely derivative forms. It is varied also by arrangements of material, as when the cactus staves are wattled with reeds or withes, and the house tends to become square in plan with vertical walls eventually plastered by the washing of mud from the roof and by the throwing up of embankments as wind-breaks below. Under the imitative instinct of savagery the wattled walls are coated with a mortar of mud, which is hardened by embedding in it pebbles and larger stones; and this may be deemed the secondary type of aboriginal architecture in the south-western United States and northern Mexico. From it develops, under favourable conditions, a third type, that of rubble masonry set in a mortar of mud or even laid dry; but where building stone is lacking, the pebble-set wattle structure grows into a distinctive architecture of which the basis is the puddled wall, or pisé, called by Spanish settlers cajon, the fourth house type of the arid region. Aboriginally, the earth used in the structure was doubtless tamped between wattled walls, at first permanent and afterwards temporary; certainly, during later times the earth was built up in successive tiers between movable screens of wattling so placed and braced as to form a temporary trough for each layer. The cajon structure was durable and was susceptible of development into communal houses of many rooms and several stories. As in the primal type, the roof consisted of earth laid on brush supported by a sheathing of canes or cactus staves and rafters of cedar poles: on one-story houses it was a place of temporary resort for the occupants, and with the gradual evolution of parapets and the growth of these into higher stories the roofs became upper floors. Subsequently (probably after the Caucasian invasion) earthen bricks laid in mud mortar came into use, and this kind of construction, known as adobe, was generally adopted; in the better buildings, both cajon and adobe walls were coated with a thin plaster or slip fixed by a soda or other earthy salt. The aboriginal cajon house type is admirably adapted to the present needs of the arid region, and is well worthy of consideration by Caucasian settlers. Properly constructed cajon walls are much superior to adobe in homogeneity and strength, though somewhat more expensive of labour. Their durability is sufficiently attested by Casa Grande in the Gila valley, which was a ruin of immemorial antiquity when discovered by Padre Kino in 1694, and is still standing despite vandalism as well as natural weathering. Moreover, the cajon is readily susceptible of improvement by the addition of lime or cement to the material in any desired quantity, and by substituting a plaster of lime or cement for the simple slip. So improved, the native construction would seem better adapted to the conditions and requirements of habitations in the arid region than any imported models. The cost would be only that of the lime and the handling of materials, while wood, burned brick, and even stone are highly expensive. The thick walls would effectively equalise interior temperatures despite the enormous diurnal range, which is the most serious obstacle to residence in arid districts; and the general massiveness would lend itself to distinctive and desirable architectural effects.

"Dr. Russell's researches extended also to the lighter and more composite types of construction surviving among the Pima and neighbouring Indians, as well as to the attendant industries and food sources. Among the latter the fruit of the cactus figures prominently, not only in modern customs but in tradition and ceremonies, attesting the still more important place which the fruit and its products occupied in the time of past generations. . . .

"Dr. Albert E. Jenks's memoir on the Wild Rice Gatherers of the Upper Lakes is especially valuable in that it calls attention to a widespread food source largely used by the aborigines and giving promise of great utility to citizens whenever the requisite attention is given to cultivation, milling, and preparation. In food value the wild rice ranks high among cereals, and its natural habitat is such that by its means otherwise useless lands may be utilised and reclaimed, while it cannot be doubted that with judicious cultivation it might be adapted to a widening range of soil conditions. Later in the year Dr. Jenks resumed his researches concerning the birch-bark industries of the northern aborigines. One aspect of the industries clustering about the birch-tree is of prime significance to ethnologists in that the birch-bark canoe was the most effective agency of distribution of tribes and culture during early times; moreover it is well worth noting that the interest is a living one, since the bark canoe remains a most effective device for transportation for white as well as red men. Indeed, its use by white tourists, fishermen, and hunters is apparently increasing in the northern United States and Canada. Various birch-bark artifacts are in use among white as well as natives. The half-conventional, half-symbolic makok, or maple-sugar box, proves a convenient household utensil; birch-bark baskets of different forms are found useful as well as artistic; and on the whole it would appear not only that the birch-bark industry is increasing in consequence of demands by whites, but that it serves as a useful stepping-stone from the primitive customs of the Indians towards the free and self-supporting citizenship which is the Indian's ultimate goal."

Mrs. Stevenson's account of the Zuñi Indians of Western New Mexico, in the second part of the volume, is full of interest, and is most beautifully illustrated, the illustrations embracing practically the whole life of the Indians, while those of the gods and of the masks, etc., used in the religious ceremonies are specially valuable. Rain-making plays a very important part in the religious life of the Zuñi, as is only natural in the case of an agricultural people living in a very dry climate. But the religion has a strong moral influence on the people, for they firmly believe that the gods will only grant the inestimable boon of rain to those who are truthful, gentle, and have their passions under control. Mrs. Stevenson seems to have been very successful in obtaining the confidence of the women, and in consequence her account is very full from the domestic side, and she admirably succeeds in giving a living picture of the domestic economy of this interesting people. It is only possible here to note one or two of the more generally interesting points.

As to dwellings, "a Zuñi pueblo resembles a great beehive, with its houses built one upon another in a succession of terraces, the roof of one forming the floor or yard of the one next above, and so on till in some cases five tiers of dwellings are successively erected; only a few houses are, however, more than two stories in height. Among the Zuñis, as among more civilised peoples, riches and official position confer importance upon the possessor. The wealthy class live in the lower houses; those of more modest means, next above; while the poorer families, as a rule, content themselves with the uppermost stories. No one, naturally, would climb to the garret who had the means to live below. The houses, which are built of stone and adobe, are clustered about three plazas, or squares, and a fourth plaza is on the west side of the village. There are three covered ways and several streets.

"The women delight in house-building, especially in plastering the houses. They consider this their special prerogative, and would feel that their rights were infringed upon were men to do it. Men lay the stone foundations, build the walls, and place the huge logs which serve as beams to support the roof. These logs are brought from a long distance and are dressed by the Zuñi carpenter. After the logs are placed, carefully selected willow boughs are laid crosswise upon rafters, brush is spread over these, and the whole is covered with earth, forming a roof substantial enough for this climate. Little girls assist in bringing the water used in mixing the mortar, working industriously, and trudging from the river with their diminutive vases on their heads in a fashion quite Egyptian.

"The lower houses, as well as those above, have outer doors; hatchways in the roof, through which ladders pass, serve as other entrances. The doorways are so small that in many instances it is difficult to squeeze through, yet they are an improvement on the more ancient entrances, which were in some cases circular openings in round stone slabs of considerable thickness, just large enough for one to pass through by assuming a horizontal position. These doorways were closed with round stone slabs held in place by props of strong poles. The houses are so provided with interior doors that almost the entire older portion of the village can be put in communication without passing outside the communal structure. Small openings made in the walls to admit light are filled with irregular pieces of selenite. The chimneys are composed of cooking utensils with perforated bases, placed one upon another and cemented together. When a cooking pot can no longer serve its original purpose, it is stored away for future use in the chimney. After the house is constructed, the exterior and interior walls are covered with a reddish-brown plaster made of earth and water. It is applied with the hand, which is swept over the wall in semicircles. In working the plaster the woman keeps her mouth filled with water, which is skilfully applied to the wall, when necessary, in the manner in which a Chinese laundryman sprinkles clothes. The inner walls are whitened, and for this purpose a white clay is dissolved in boiling water and applied with a rabbit-skin glove. The gloved hand is dipped into the liquid and then rapidly passed over the wall. The colour of the outer walls is usually dark."

As regards agriculture, "much of the corn and all of the wheat is raised in the farming districts of Nutria, Pescado, and Ojo Caliente. The cornfields also spread over the land near Zuñi and elsewhere. In most instances the fields remote from the farming districts are not irrigated. The corn is grown in clusters so as to give a better chance for development in this arid land. The three farming districts are each irrigated from a spring. The description of one will answer for all. The spring To'seluna at Ojo Caliente is at the base of a low limestone mountain. The body of the spring, which is deep, is between 35 and 40 long, and 18 by 20 feet wide, and is a beautiful, clear sheet of water. The Zuñis say that a man may sink to his neck, but the force of the water as it comes from the earth is so great as to prevent his feet touching bottom. It is said that a woman returning to Ojo Caliente with a burro loaded with milling stones, about twenty-five years ago, allowed the little animal to go into the spring to drink. The weight of the stones carried him to the bottom, and he disappeared for ever from sight.

"Two ditches extend in different directions from the spring for irrigating the fields. The main ditch waters an area about 3½ by 2½ miles, while the other does not irrigate so large a surface. Since the main ditch is lower than the other it often becomes necessary to dam it in order that a greater force of water may go from the spring into the higher ditch. To accomplish this earth is banked between a number of tree boles which stand in line where the water of the spring flows into the ditch. The damming is done by the master of the ditch at the request of those who desire water from the higher ditch. No stick or board or any other kind of water measure is used by the Zuñis, and there is no history or legend among them of the employment of such articles. Disputes over the water seldom occur; when one does occur the governor of Zuñi settles the question. It is the business of the governor to see that the water is fairly distributed."

When Mrs. Stevenson visited To'seluna spring in 1904 she found men making, under the direction of the master of the ditch, a temporary ditch to enable a woman to water her garden, which was on the elevation immediately above the spring. In order that the water might reach this garden it was necessary to dam both the main ditches.

"Muskmelons, watermelons, squashes, and gourds are usually grown near the cornfields. When the corn and melons begin to ripen the fields are constantly guarded, and for this purpose rude shelters are erected. The country is so infested with ravens that the Zuñis have become expert in the construction of scarecrows. The majority of the Zuñis leave the village and settle in comfortable houses in the farming districts for the summer, remaining as late as possible in the autumn. Some few have found the country home so greatly preferable that they have taken up their permanent abode at their farms, but this does not prevent their prompt attendance at ceremonials held in Zuñi.

"When the corn is gathered it is brought home and spread on the roof. After the husk has been removed the ears are stacked with much precision and care in the storage-rooms. . . .

"The soil is harrowed with primitive implements, and the wheat is threshed in the farming districts where it is raised, goats and occasionally horses taking the place of threshing-machines. The wheat is winnowed by tossing it in baskets made for the purpose. It is stored either in large bins constructed of stone slabs, or in immense pottery jars in the storage-rooms. A Zuñi storage room contains a promiscuous mass of material, ranging from objects of the most sacred character to those of little or no value.

"The Zuñis aim to keep a year's supply of grain on hand untouched to provide against failure of crops. They have learned this lesson from experience. Starvation has some times compelled them to seek relief from other pueblos. Neighbouring tribes have also sought aid from the Zuñis for the same reason.

"Onions, chillis, a species of amaranthus (used for imparting a red colour to the wafer bread), and a variety of herbs used as condiments are raised exclusively by the women in little gardens in the farming districts and at Zuñi. In Zuñi these gardens, which are protected by adobe walls, are at the southern edge of the village on the river front. The energetic little women may be seen at daybreak carrying vases of water from the river and watering their gardens, which require constant care in order that they may not be parched by the burning sun.

"Watermelon, muskmelons, beans, onions, and chillis, which are raised in great abundance, are grown not only for summer consumption, but are preserved for winter use. The watermelons and onions are laid away in the storage-rooms without preparation; the muskmelons are seeded from the end, pared, and hung on crotches of low trees which are found at the farming districts. Squash is cut into long strips, as one would pare an apple, formed into hanks, and dried in the sun. Chillis, which are gathered when red, are strung together and hung on the outer walls to dry. The brilliant red against the sombre adobe wall gives a pleasant bit of contrasting colour. All edible plants are cured for winter use, most of them being tied in bunches and hung in the storage-rooms, as are also the medicinal plants.

"Peaches are raised in the foothills, where there is more moisture than below. The trees are low, many of them not over three feet in height, some even less. Their spreading limbs are laden with fruit when the season is favourable, but the crop is plentiful only every other year. When the fruit is ripe all families that have orchards, or some of the members of each family, move to the orchards and remain in temporary huts or permanent structures until the fruit is gathered, in many instances until it is dried. Though the fresh fruit is greatly enjoyed, and even green peaches stewed and sweetened are a treat, care is taken to dry large quantities for the winter. The Palle family, the richest in Zuñi, dry their fruit on the top of a great rock, which appears to be inaccessible to any but an Indian."

Very interesting is the description of the annual journey to the Zuñi salt lake in search of salt, and the account of the way in which this necessary expedition has become intertwined with the religious life of the people. The salt lake is situated about 42 miles from the pueblo.

Here a round crater-like depression sinks abruptly from the surface of the plain, and is about a mile broad and 220 feet deep. In the centre of the depression arise two symmetrical volcanic cinder cones about 150 feet high, to the north of which lies the salt lake, while to the south is a nearly smooth plain floored with wash from the slopes. The lake is an oblong body of water extending east and west across the northern end of the depression, with a length of about 4000 feet, and a somewhat less breadth. Apparently at one time the lake occupied the whole area of the depression, but by evaporation and deposition of mud it has diminished in size. The waters of the lake are saturated with salt, and as evaporation progresses the salt is deposited.

Some time in July the priests announce that the journey to the lake will take place in four days, and at sunrise on the appointed day the party assembles. The party is composed of men only, who are provided with choice food for the occasion by the women, and go through certain preliminary ceremonies, including a process of bathing. All the village turns out to see the start, and all offer prayers for a safe journey. The actual journey takes two days, the lake being reached on the evening of the second day. The lake is the source of the salt supply of all the Indians far and near, and ranks as neutral ground, and even in times of war parties were formerly safe from attack so long as they remained within the recognised boundaries of the lake.

At sunrise on the morning following the arrival the priests visit the home of the gods of war, which is supposed to be in the depths of the crater, and there deposit offerings. After a somewhat elaborate ceremonial the salt collecting begins, each person providing himself with a piece of cloth in which to place the crystals scraped from the bed of the lake. On the return journey signal fires are lighted as the party approached the village, and the villagers then turn out to welcome the salt-gatherers. The salt has not only a dietetic value, but has also strong religious associations.

It is not possible here to give any further account of the vast series of observations made by Mrs. Stevenson, but it may just be mentioned that as regards medical practice these Indians seem in a very interesting transitional state, for they combine magical practices with a very intelligent and non-religious use of drugs, massage, etc. Only where the disease is complicated or mysterious is there a tendency to regard it as due to witchcraft and to employ magical means of cure. The theurgists, who are usually men, but are sometimes women, show some skill in surgery, especially in the treatment of fractures and dislocations. Further, Mrs. Stevenson discovered the interesting fact that the Zuñi use thorn-apple (*Datura stramonium*) as a narcotic for the performance of surgical operations, as well as for external application, and for magical purposes. Belief in witchcraft is universal, and frequently leads to tragic consequences. As elsewhere, witches are believed to be able to assume animal shape, and the cat is believed to be a favourite form with them; but for details as regards this and many other curious points reference must be made to the original volume. Enough has however been said to give some idea of the mass of interesting material which Mrs.

Stevenson's care and labours have brought together as regards these Indians.

Erratum: The York Meeting of the British Association.—On p. 526 of our last issue, in the paragraph relating to Mr. Rudmose Brown's paper, the concluding part of the sentence should read as follows: "the movements of the ice in the vicinity of these islands afforded in his opinion evidence against the theory of the *insularity* of Graham Land," instead of the *continuity* of Graham Land as in the text.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

Award of Medals.

At a meeting held in the Society's Rooms on the 17th October, it was unanimously decided by the Council to award the following medals:—The Society's Livingstone Medal for 1906 to the Right Hon. Sir George D. Taubman Goldie, P.C., K.C.M.G., F.R.S., D.C.L., LL.D., President of the Royal Geographical Society, the "Founder of Nigeria," in recognition of his services in extending civilisation and commerce in Africa; the Society's Gold Medal to His Serene Highness the Prince of Monaco for his important researches in Oceanography; and the Society's Silver Medal to Professor W. M. Ramsay, D.C.L., LL.D., Litt.D., of Aberdeen University, in recognition of his valuable work in connection with the Ancient Geography of Asia Minor.

Diploma of Fellowship.

The Council conferred the Ordinary Diploma of Fellowship on Robert Hinde Douglas, F.R.G.S., of Kowloon Customs, China, a member of the Society, who had complied with the prescribed conditions.

Glasgow Centre.

Members of the Glasgow Centre will have the advantage of the new arrangement made with the Royal Philosophical Society of Glasgow, whereby that Society's very complete Library at 207 Bath Street, Glasgow, will be available to them without extra payment. The arrangement commences in November.

Members desirous of exercising this privilege must exhibit their membership cards to the Librarian at 207 Bath Street, in order that their names may be registered, and they must conform generally to such regulations as may from time to time be laid down by the Royal Philosophical Society.

The private room at 207 Bath Street, presently rented, has been retained for the exclusive use of members of the Glasgow Centre.

The New Session.

The Anniversary Meeting at Edinburgh will be held on November 22nd in the Synod Hall, at 8 P.M., when the Right Hon. Sir George D. Taubman Goldie, P.C., K.C.M.G., F.R.S., D.C.L., LL.D., President of the Royal Geographical Society, will deliver an address entitled "Geographical Ideals."

Professor James Geikie, D.C.L., LL.D., F.R.S., President of the Society, will preside.

Sir W. Martin Conway, M.A., F.S.A., F.R.G.S., will open the session in Dundee, Aberdeen, and Glasgow, on the 26th, 27th, and 28th November, when he will deliver an address on the "Climate, Resources, and Geography of Southern Peru and Bolivia."

Sir Martin Conway will repeat his address in Edinburgh on the 29th November.

New Members.

Members are requested to make an effort to increase the efficiency of the Society by obtaining new Members. A form of application is sent out with each copy of this month's *Magazine*.

Annual Business Meeting.

The Annual Business Meeting will be held in the Society's Hall, National Portrait Gallery, Queen Street, on Thursday, 8th November, at 3.30 P.M.

Professor James Geikie, D.C.L., LL.D., F.R.S., President of the Society, will take the Chair. The attendance of Members is particularly requested.

GEOGRAPHICAL NOTES.

Europe.

Results of the German Census.—The results of the Census of the German Empire, taken on December last, show a steady increase of population. The total population of the home empire was 60,605,183, an increase of 7·52 since the census of 1900. Prussia, with a population of nearly two-thirds of the total, has grown faster than the rest of the empire, the increase during the past five years being 8·14 per cent. Growth has been most rapid in the three western provinces in the valley of the middle Rhine—Westphalia, Rhineland, and Hesse-Nassau—which, with an area of less than one-fifth of Prussia, contain nearly one-third of the population. In the county of Potsdam the increase has been exceptionally rapid, being 20·66 per cent. in the period, while the increase in the city of Berlin has been 8·01 per cent. This city has now 2,040,222 inhabitants. In no province or county of Prussia has there been a decline in the population during the period, but the increase in the eastern provinces, occupying the sandy North German plain, was

below the average both of Prussia and of the rest of the Empire. In western and north-western Germany the population is increasing very rapidly, as instanced in Hesse and Oldenburg, where the increase per cent. measured 8·14 and 9·77 respectively. On the other hand, in the highlands of Central Germany the increase was comparatively slight, mostly 3, 4, or 5 per cent. The increase in Alsace-Lorraine, whose population declined from 1871 to 1885, is still continuing, the increase during the last five years being 5·53 per cent. As in other countries, the population of the towns is tending to increase at the expense of the rural, the increase in Bremen, for instance, being 17·14 per cent. for the period. Of the total population 29,868,096 are males, and 30,737,087 females.

Mediæval Spanish Maps.—A recent issue of the *Boletin de la Real Sociedad Geográfica*, contains a contribution by Don Antonio Blázquez on Spanish Cartography during the Middle Ages. While giving a sketch of the history of Cartography in general, the main object of the article is to put forward the claim of Spain to have kept alive the study of map-making during the dark ages. Vivien de St. Martin has said "that 500 years elapsed from the time of Charlemagne without there being found in the documents of those times the slightest indication to show, if not the existence, at any rate, the knowledge of maps analogous to those of his time," etc., etc. St. Martin adds that the oldest maps were the Anglo-Saxon, instancing that which bears the name of Robert Haldingham in Hereford Cathedral.

This assertion is traversed by the writer of the article, who maintains that while Europe was under a condition of intellectual lethargy which led to the term "dark ages" being applied to that period, the Peninsula was on the contrary enjoying a development of great mental activity, a time *de luz vivísima* and that during that period there were several noted mapmakers.

There exists, for instance, in the library of Alby a map which was made for the work of Orosius in the eighth century. It has been thought by many that this map corresponded to the "*Situ et descriptio orbi*" of Etico; but the writer holds it abundantly proved by Libri, Vizconde de Santarem, Kretschner and others that it accompanied the *Historia contra los Paganos* of Orosius. This map contains a peculiarity which seems to mark it as Spanish in that the name of Spain is written in larger letters than the other titles.

Again, Isidore of Seville, who wrote the famous Etymologies, had them illustrated by maps, of primitive character and poor in details, it is true, but none the less very interesting.

Another map is mentioned as existing in a manuscript in the Biblioteca Nacional, having come from Toledo, and being supposed to date from the ninth century. Of the tenth century are the Codices Vigilano and Emilianense both containing geographical representations which are described.

One of the most important maps of the Middle Ages was that associated with the commentaries of San Beato de Liébano. The date

of the Távara specimen is 970, and this is one of the oldest, and it is held that the example at Turin is a copy, as is the one in the Bibliothèque Nationale of Paris. The Valcavado example, now in the University of Valladolid, is of the same age as that of Távara, both being dated 970, and both of Spanish origin. Space does not admit of entering into the details of the various maps which are described with great care; it will be sufficient to recapitulate the names of Orosius, Isidore, and San Beato as having certain copies of their works illustrated by maps, the work of Spanish cartographers, executed at a time when the science was in abeyance in the rest of Europe.

The paper, which is rather involved in style and at times somewhat obscure, is illustrated by several maps which are very interesting.

Africa.

African Languages.—We have been requested to publish the following letter from Mr. A. C. Madan, who is now examining the dialects of Northern Rhodesia:—"The importance of language in relation to political and social aspects of the native question in Africa seems liable to be overlooked. The possibility of large groups of tribes, hitherto distinct and mutually antagonistic, becoming rapidly able and eager to understand each other in some common form of speech, has apparently to be taken into account. Twenty-six years' contact with Swahili and various dialects of Eastern and Central Africa points, so far, to the conclusion that there is a remarkable degree of similarity, amounting in many important respects to substantial identity, in the grammatical structure of language over the whole vast area occupied by the Bantu races of Africa, from the Soudan to the Cape. And the stock of words common to all Bantu tribes, when recognised under their various dialectic disguises, will probably prove very considerable.

"The officials, missionaries, traders, settlers, and travellers of various nationalities who are qualified to give help in testing this conclusion by personal and first-hand study of a Bantu dialect are naturally difficult to reach, scattered in remote and often isolated spheres of work. It is therefore perhaps justifiable to ask publicity for the request, that persons so qualified and willing to accept and reply to a brief communication on the subject would send me their addresses to c o British South Africa Company, Fort Jameson, North-Eastern Rhodesia. I should be grateful if foreign journals and local papers in Africa, general and official, would assist by calling attention to my invitation."

America.

The Earthquakes of Peru.—In connection with the late seismic disturbances in South America it is of interest to note an article in the *Boletin de la Societa Geográfica de Lima* for 1904, which gives a synopsis of the earthquakes of Peru for the past three hundred years. The record ranges from 1647 to 1748; then after a hiatus of about one hundred and fifty years, from 1900 to 1904. The earlier notes were

evidently kept by the church. Indeed this is from time to time expressly stated, but it is made quaintly apparent throughout by certain modes of expression and by allusions. For example, the duration of a disturbance is calculated not by minutes but by credos—a given shock lasted for two credos, another an avemaría. Also prominence is given to the occurrence of miraculous phenomena, the restoration of pictures of our Lady, and the like.

The article makes it clear that the West Coast of South America, and especially the province of Cuzco, has been from all historical time the "Land of Unrest." Making every allowance for probable inaccuracies in observations, for exaggerations and stories tinged with the superstitions of the age, there still remains a tale of the most appalling devastations. Hardly a year passed without its earthquake; sometimes not one, but many. In 1647, for instance, the shock was so terrible that "in less than four credos" the city of Santiago of Chile was devastated, and more than one thousand persons killed; and within two and a half months there were no less than 120 shocks.

Two years stand out with evil pre-eminence. In 1650, within the space of two credos, as noted in the Library of the Chapter, the city of Cuzco was razed to the ground, the churches, convents, and houses mostly ruined. Nor was this the worst; between the 31st March and the 20th May there was no less than 226 shocks of earthquake. The loss of life must have been very great, not only from the disturbance itself but from the destitution and sickness which followed, and the torrential floods. "Truly," as the chronicler said, "to live in this city is to die in the midst of so many terrors and excitements."

Again, in 1746, there occurred in Lima the most formidable disturbance of all. On the 28th October 10,000 persons were said to have perished during a shock which was followed by a tidal wave. The cathedral fell, monasteries and hospitals were reduced to ruins, burying their inmates in the downfall; the palace of the Viceroy collapsed, likewise the Inquisition, and successively all the churches and houses. The earthquake was felt 100 leagues north and south of Lima. Not to enter into details, during 112 days, from 28th October 1746 to 16th February 1747, there were registered 400 shocks of earthquake.

The San Francisco Earthquake.—In connection with the report on this earthquake, which we published in our August issue, attention should be drawn to an illustrated article by Professor G. K. Gilbert in the *Popular Science Monthly* for August. The article gives a clear and interesting account of the phenomena of the earthquake, and the figures which accompany it are most instructive, and are recommended to the notice of all those interested in the subject. The article is followed by a more technical paper by Dr. Bauer on "Seismograph and Magnetograph Records of the San Francisco Earthquake, April 16, 1906."

The Freshwater Fish-Fauna of South and Middle America.—An article by Professor Eigenmann on this subject in the *Popular Science*

Monthly for June is of some interest from the geographical standpoint, especially in relation to the history of the South American continent. The area between the Caribbean Sea and the Argentine Republic is characterised by its enormous wealth of fish life, a fact which is directly associated with the enormous water system, which extends from 10° N. to 35° S. lat., and from 50° to 79° W. long., and embraces the basins of the Orinoco, Amazon, and La Plata, draining over 3,000,000 square miles of territory. But in spite of the wealth of species, family types are few. On the other hand, the freshwater fauna of middle America is poor, and that of the Mexican plateau is peculiarly isolated. The fauna of the Pacific Slope is also poor, as is also the case in the same slope in North America. The fauna of the large Lake Titicaca is marine in character and must have been received directly from the sea. The freshwater fish-fauna of Patagonia is again poor, but it is of much interest because of its difference from the Brazilian fauna, and the presence of forms related to the fish of New Zealand, the Cape of Good Hope, etc. In view of the amount of evidence which has accumulated as to the former existence of an Antarctic Continent connecting the land-masses of the Southern Hemisphere, the author believes that there must have been formerly a large freshwater fish-fauna in Patagonia, which was in large part exterminated by the submergence of large parts of that country during late Pliocene times, and only those forms which were indifferently marine or freshwater were able to survive.

North America has not contributed a single element to the freshwater fish-fauna of South America, but there is much evidence of relationship between the fishes of South America and of Africa. So close is this relationship as, in the opinion of the author, to leave no doubt that some land connection formerly existed between the two continents, and that this connection was before the time of the origin of the existing genera, and before that of many of the existing families.

The origin and distribution of the freshwater fishes of South America the author explains as follows:—In the earliest period of the Tertiary time, tropical America consisted of two land areas, separated by the lower valley of the Amazons, which was still submerged. A land-mass lay between Africa and South America, and was possibly in contact with Guiana in South America, and with some point in tropical Africa. This land-mass had a considerable fish-fauna, and when it sank below the waves all the fish were exterminated except those which had moved east or west. It was in this way that the diverse but related fish-faunas of Africa and South America arose. Later the Cordilleras arose out of the ocean at a distance from the then existing land-masses of South America too great for their streams to be colonised from these land-areas, and thus the developing Cordilleras became stocked with marine types. With the further elevation of the Cordilleras and the formation of the systems of the Orinoco, La Plata, and Amazon, these systems became colonised from the surrounding land-masses, and the comparatively few types then existing diverged in all directions and gave rise to the existing fish-fauna.

Immigration into Cuba.—A recent article in the *Bollettino dell' Emigrazione* (5, 1906), gives some statistics regarding the immigration into Cuba during the year 1904. In that year 29,116 persons entered the island, and of these Spain (including the Canaries and Balearic Islands) contributed 23,759; or in other words, 80 per cent. of the immigrants are of Spanish origin. As to sex, 24,372 were males, and only 4744 females. Of the total number about 75 per cent. had a profession or occupation, and about one-third (9006) had been previously in the island.

Polar.

Arctic Expeditions.—The Mikkelsen Expedition has encountered many difficulties owing to bad weather and the state of the ice, and the last news received makes it certain that the plan of going into winter quarters in Prince Albert Land cannot be carried out. Since the expedition will be compelled to winter instead in northern Alaska, Mr. Mikkelsen hopes to carry out his original scheme of work by remaining an additional year in the Arctic. The expedition reached Point Barrow on August 15, and intended to push on as far as possible, but letters dated September 1 indicate that very little further progress had been made in the fortnight. The naturalist of the party, Mr. Detlevsen, had to be left behind at Fort Clarence on account of serious illness.

The *Gjoa* with the Amundsen Expedition on board arrived at San Francisco on October 19.

Of the other Arctic expeditions, that conducted by Mr. Harrison is carrying on good work in spite of unfavourable ice conditions. Mr. Harrison expects to winter at the mouth of the Mackenzie River, and last year made a route survey between the Arctic Red River and the Peel River.

The Scottish National Antarctic Expedition.—During this expedition several thousand floats were thrown overboard, of which five have been returned to the British Admiralty. The most recent one to arrive is of special interest as having probably made the longest journey of any float. This float was thrown over on the 26th January 1904 in latitude 43° 10′ S., longitude 54° 17′ W., and was found on the beach of Bridgewater Bay, August 4th, 1906. Bridgewater Bay is between Cape Nelson and Cape Bridgewater near Portland, SW. of Victoria, Australia. The distance in a straight line is approximately 9000 miles, which gives a mean drift of 10 miles a day in a easterly direction. It is of course unlikely that this float travelled in a straight line throughout this long period, so that the daily drift was probably considerably greater than the figure indicated.

General.

The Fauna of the Deep Sea.—During the present year a series of articles have been appearing in the *Revue Générale des Sciences* on the results of the Prince of Monaco's last scientific campaign, as considered from the naturalist's point of view. Well-written and illustrated, these articles may be cordially recommended to all those interested in oceano-

graphical work. Very striking is especially that devoted to the fauna of the great depths, which is illustrated by a great number of figures showing the special peculiarities of the animals which spend their lives in the cold, dark, depths of the ocean. The author, Professor M. E. Bouvier, gives also some account of the methods adopted in studying the deep-sea fauna. Although of recent years the chief facts regarding these strange creatures have become more or less readily accessible, yet descriptions of them for the most part require to be sought in scattered volumes, and there is therefore ample room for such a full and fresh first-hand account as that of M. Bouvier's.

Man and the Glacial Period.—During May and June of the present year Professor Sollas delivered a series of lectures on this subject at the Royal Institution, an abstract of which appears in *Nature* for August 9. The lectures are of interest to the geographer as bearing upon the probable origin of certain existing races of men from Palæolithic ancestors, and we therefore summarise here Professor Sollas's conclusions. He accepts Dubois' *Pithecanthropos erectus* of Java as the earliest known representative of the human family, but considers that certain of the eoliths of the gravels of southern England may be accepted as evidence of the still earlier existence of man-like species. Some of these eoliths closely resemble the scrapers once used by the Tasmanians for making wooden spears, and suggest affinity between the race making them and the very old race of Tasmanians. The next, or Chelléan stage of culture, is represented by stone implements found in Southern France, and in possibly corresponding gravels in the valley of the Thames. The men of this age are known by various skulls, *e.g.* the Spy, Neanderthal, and Krapina, types all of which evidently belong to the same race. The nearest relatives of these men are the living Australians, which closely resemble them in cranial capacity.

Upon the Chelléan stage of culture follows the Solutrian, represented by implements found in the loess of the Danube. To the men of this race are ascribed the drawings and paintings found in the caves of France and Spain, which in spirit and technique recall the work of the Bushmen of South Africa. Professor Sollas considers that the evidence is sufficient to permit us to regard the Solutrian race as ancestral to the Bushmen. The last of the definitely Palæolithic races is that of the reindeer hunters, or the Magdalenian race. They lived under somewhat severe conditions of climate as contrasted with the artist race of the Solutrian stage, whose members lived under genial conditions. Professor Boyd Dawkins first pointed out the resemblances between this people and the Eskimo, and though his conclusions have been disputed, Professor Sollas considers that recent evidence all goes to support the suggestion of ethnic connection between the two races. Professor Sollas believes that the osteological evidence, as deduced from a study of the skeletons in the Mentone caves, all goes to show that in Magdalenian times there were two contemporaneous races, allied to one another, one of which is now represented by the Eskimos, and the other by neighbouring North American tribes.

It is worthy of note that if Professor Sollas is correct in his view of the origin of the Bushmen and the Eskimos, then the varying climatic conditions of the Pleistocene period have acted upon the human species precisely in the same fashion as upon other mammals—that is, warm periods drove the cold-tolerating forms to the north, and cold periods the heat-loving forms south. We may say, indeed, that Greenland in its human inhabitants no less than in its other mammals and in its climate is a relic of the glacial period.

A New Colonial Journal.—We have received the first number of the *Rivista Coloniale*, the organ of the Instituto Coloniale Italiano of Rome. This publication is intended to further all that concerns colonial enterprise and emigration. The editorial Foreword which serves as an introduction, points out how much the commercial expansion of Italy has suffered from the want of reliable information, and of a guiding hand. There is plenty of energy in the country, abundance of enthusiasm, but what is lacking is accurate knowledge, clear ideas, so that each one may know how best to direct his energies. This the Instituto Coloniale Italiano proposes to do by means of this new organ. There are to be departments devoted to political and scientific subjects, others to economic and commercial questions; while much attention is to be devoted to emigration and to the study of the Italian colonies of Erythrea, Somalia, and Benadir, and their wants.

The first article in the present number deals with the Algeciras Conference from the Italian point of view. It is too political for any extended notice in these columns, but will interest those concerned. Another paper deals with the commercial expansion of Italy, showing that she is too apt to look on herself as a purely agricultural country, and to neglect the industrial side of the question. Many valuable suggestions are made with the object of encouraging manufacturers to co-operate in colonial expansion.

There are many other articles worthy of study, but we have sufficiently indicated the scope of this new venture. We believe it to be a step in the right direction, that it will be of great service to the cause of Italian colonial expansion, and we give it a very cordial welcome.

The Royal Geographical Society of Australasia.—This Society celebrated its twenty-first anniversary at Brisbane in June last by a festival which lasted over four days. Various social functions were taken part in by the members, and at the evening meetings papers by Dr. Hugh Robert Mill (on "Present Problems of Geography") and by Prof. R. E. Dodge ("School Geography") were read. Sir John Murray also wrote a paper on the oceanography of the South-western Pacific specially for the Society. At another meeting an address was given by the Secretary, Dr. J. P. Thomson, on the history of the Society.

Commercial Geography.

The Food-Supply of Towns.—It has until recent years been a commonplace of economics that all the more perishable parts of the

food-supply of towns must originate from the near neighbourhood, and the extent to which this dictum is undergoing modification day by day is perhaps not fully realised. It has always seemed to the writer of the present note that one of the most successful methods of giving early lessons in geography to town children might be to take the seasonal changes in the contents of the food-shops of the town, trace the source of each article, show how the resources of every climate and soil have been exploited, and follow the evolution of the means by which all the difficulties of transport and carriage have been overcome. A recent article in the *Revue Générale des Sciences* shows what might be done in this way by tracing the changes which are now taking place in the supply of fruit and vegetables to the Paris market.

As is well known, Paris is surrounded by a zone of market-gardens, cultivated by men whose skill has become a proverb. The economic impulses which have led to the development of this skill are varied, but the proximity of an almost inexhaustible market, and the abundant supply of stable litter which the transport animals of the town yield, are among the most important. So great is the skill which these forces have produced, that the gardeners have not only kept their own market from competitors, but have also conquered others, and have sent their products to Russia and Germany. But of recent years a new set of economic forces has come into play. In the first place human skill is triumphing over the difficulties of the transport of perishable articles of food, and the gardeners of Paris have now to compete against Southern produce grown with all the advantages of soil and climate, instead of in spite of all disadvantages. Secondly, the steady increase in methods of mechanical traction in Paris itself, and the increasing tendency to employ other litter than straw in stables, are leading to a diminution of the amount of the manure which is essential for the market-gardeners' hot-beds. The result is that the place of the delicate and costly local products is being taken in the Paris markets by cheaper and coarser fruits and vegetables, grown especially in Algeria. The author of the article, M. J. Dybowski, gives a table showing the increase in amount of the vegetables imported from Algeria into France during the last few years. In 1899 about 111,000 cwts. of new potatoes were imported, and about 58,000 cwts. of other vegetables, while in 1903 the figures had risen to nearly 167,000 cwts. and 107,000 cwts. respectively, and the increase is steadily continuing. The methods of putting the produce on the market are also improving. Vegetables and fruit from Algeria are now delivered at Marseilles twenty-four hours after loading, and at Marseilles are put on board a special train, whose waggons are maintained at a constant temperature summer and winter. The result is that in a little more than forty-eight hours produce can be transported from the fields of Algeria to the markets of Paris. Much still remains to be done before the colonial produce rises to the standard of the local, but the author of the article is of opinion that the local gardeners will be wise to learn that they cannot hope to prevail against the new forces being brought to bear, and will utilise their hereditary skill in solving the new problem of raising suitable races of plants for the new conditions.

EDUCATIONAL.

UNDER this heading we propose in future to devote space, month by month, to the consideration of matters of special interest to teachers. It has always been one of the aims of the *Magazine* to promote the scientific teaching of geography by drawing attention to books, articles, etc., of educational importance, but it is felt that it may be of more help to teachers to find columns specially devoted to their wants. Apart from the new books and new maps which are periodically catalogued in our pages, there comes into the library an enormous supply of material of directly educational value, and it is one of the objects of the new departure to make this more readily available. Further, special efforts are now being made to keep the Society's collection of text-books and teaching material thoroughly up to date, and to have a selection of the most useful modern books and maps permanently on view in the library, for the inspection of those interested. The editor also invites correspondence from teachers and others in regard to methods of teaching, and will be glad to answer queries so far as possible, either directly or through the medium of the *Magazine*. Notes as to the results obtained by particular methods will also be welcomed, as some of the discussions and suggestions of recent years have shown a tendency to become academic, and to forget the actual conditions in the average school. The Council has under consideration a scheme whereby the benefits of the Society may be extended to teachers on special terms, but meantime teachers may be reminded that the Society's library is open to the public daily, including Saturdays, so that books and papers may be consulted even by those who are not members.

Among the pamphlets which have recently reached the library, teachers will note a fourth edition of Dr. Morgan's *Practical Teaching of Geography in Schools and Colleges* (London: Philip and Son, Price 6d.) We gave a somewhat full account of its contents at the time of its first appearance as an article in *The Geographical Teacher* (cf. this *Magazine*, xix., p. 486), but the pamphlet form makes the article more convenient for reference, and the fact that it has run into four editions shows that it is of real value to teachers. The second part of the paper, containing suggestions as to practical work in geography for older pupils, seems to us especially valuable, although some of the pieces of work recommended must involve the expenditure of more time than is ordinarily available.

Another pamphlet, sent by the Director of Education, Victoria, deals with Nature-study in Australian schools. For the most part the pamphlet contains a description of a field lesson at Werribee Gorge, Bacchus Marsh, given to the pupils of the Continuation School and the students of the Training College, Education Department, Melbourne; but incidentally some account is also given of the excursions and field-work undertaken by the pupils of the two institutions. Werribee Gorge is a spot of great scientific interest, and the excursion to it, which was

a very large one, fitly closed the course. We notice that throughout the previous lessons constant allusion was apparently made to the spot, an excellent means of arousing the pupils' interest in advance, and ensuring the full utilisation of the opportunity when it finally presented itself. Teachers will be interested in the means adopted to ensure that the whole of the very large party heard the explanations given. We notice that the study in detail of a river, here the Yarra, forms part of the regular course. There is no doubt that where this can be done it affords an admirable introduction to geography.

In our last issue (p. 563) there will be found recorded the publication of a new and cheap geological map of the British Islands, showing the general features of the geology of the country. Such a map is a very valuable adjunct to geographical teaching, and as the printing in the present case is singularly clear it should be possible to get an intelligent class to deduce the main features of the topography of the country from its geological structure. A study of the geology of the Highlands, again, in connection with Dr. Marcel Hardy's botanical map, published here last June, would yield many facts of great interest, and such a lesson could be made more real by the help of the series of views of Highland scenery which appeared in Sir Archibald Geikie's paper in our March issue.

Among new geographical text-books attention may be specially called to L'Estrange's *Progressive Course of Comparative Geography*, of which a review appears in our present issue (p. 619). This combines an atlas and a text-book, and is arranged on a method which makes it of great value in the scientific teaching of the subject.

An article which the geographical teacher should not fail to read appears in the *Geographical Journal* for October under the title of "The Rivers of Chinese Turkestan and the Desiccation of Asia," by Mr. Ellsworth Huntington, the course of whose travels we have followed here. Mr. Huntington states that "all the more arid part of Asia, from the Caspian Sea eastward for over 2500 miles, appears to have been subject to a climatic change whereby it has been growing less and less habitable for the last two or three thousand years." He goes on to discuss the probable effect of this upon human history in causing vast migrations of herdsmen who found the country growing gradually too dry for their flocks. The point of importance for the teacher is of course the stimulus to the imagination produced by the thought of this stupendous climatic change, and its indirect influence upon the progress of the west throughout the historic period. As Mr. Huntington points out, the term "desiccation of Asia" has been applied in more than one sense, but the changes which have taken place in the historic period, and are still in progress, are of the most direct interest to the geographer, and the evidence upon which the conclusion that they have occurred is based, is of great importance.

NEW BOOKS

EUROPE.

Origin of the Anglo-Saxon Race. By the late Thomas William Shore. Edited by his Sons, T. W. Shore and L. E. Shore. London : Elliot Stock, 1906. *Price* 9*s.*

This is an exceedingly interesting and erudite work on a difficult subject, regarding which there exists a good deal of misapprehension, viz. the origin of the Anglo-Saxon race. Up to recent times it has been generally held that the Anglo-Saxon conquerors and colonisers of England were originally Angles, Saxons, and Jutes, and it is the main object of this work to ascertain and set forth whatever evidence can throw light on this, to us, most interesting question. The evidence dealt with is divided into three classes, viz. philological, *i.e.* that of the old names and dialects in use during the Saxon period ; anthropological, *i.e.* "the evidence of human remains, chiefly skulls from Anglo-Saxon burial places, and that of similar remains of the same period from old cemeteries on the Continent ; and the racial characters of people in various parts of Northern Europe and in parts of England at the present time" ; and archæological, *i.e.* evidence relating to "customs that prevailed, especially those relating to inheritance, which are among the most persistent of early institutions. In several parts of England accounts have come down to us in the folk-lore or traditions and in historical references of a clan-like feeling between people of adjoining villages or districts. Traces of dislike or jealousy between village and village have been reported in several counties." After a careful and impartial consideration of the evidence in all its branches Mr. Shore came to the conclusion that the names of Angles, Saxons, and Jutes, "in reference to the conquest and colonization of England, were but general names for tribal people in alliance, generally the name of the largest section of such allies. They were, no doubt, convenient names, but cannot be regarded as ethnological designations." The Old English race was in truth an amalgam, in which besides Angles, Saxons, and Jutes, Danes, Norsemen, Frisians, Wendish or Slavonic, and Celtic elements can still be traced ; "it assimilated to a great extent their dialects, and the Old English speech, as it prevailed in various parts of England, was formed by this process. No example of an Anglo-Saxon language has ever been found out of Britain itself. It arose here, like the race itself, by the blending of tribal dialects, of which those of northern origin are important." It is extremely improbable, that even in this exhaustive and carefully balanced work we have the last word that can be said on the origin of the Anglo-Saxon race, as it is more than likely that fresh evidence of various kinds will some day be forthcoming. But in the volume now before us the evidence available up to now is succinctly and impartially set forth, and the conclusions arrived at are fairly substantiated. A distinct want in the work is maps, both of England and of the regions whence the colonising tribes came, but this deficiency can easily be remedied when the book reaches a second edition.

Felicity in France. By Constance Elizabeth Maud. London : William Heinemann, 1906. *Price* 6*s.*

The many readers of *An English Girl in Paris* will know what to expect in this new work of Constance Elizabeth Maud. It makes no pretension to research or exploration, but is a crisp and vivacious description of a pleasure tour by two ladies in some of the less frequented byways of France. It is a delightful book for a lazy holiday.

Highways and Byways in Dorset. By Sir Frederick Treves. London: Macmillan and Co., 1906. *Price* 6*s.*

In these days when most of us are more intimate with Switzerland and the Italian lakes than with our own land, we owe a hearty welcome to any book which will beckon us to the remoter corners of Great Britain. For this, and many other reasons, we are glad to be able to introduce to our readers Sir Frederick Treves' book on Dorset. This part of England well merits the attention of the traveller no matter what his tastes may be. If he is a student of history, he will find ample material in a country which was the cradle of our kingdom. Here, or, at any rate, in Wessex generally, Alfred withstood the formidable power of the Danes, and commenced the welding of the nation together. The lover of scenery will find every variety, and unrivalled rocky coastline looking out on the sea; Cranbourne Chase, which came to King John with his wife, "a secluded piece of England which has changed but little since the days of" that monarch. The Great Heath also, a bit of unchanged ancient Britain; all these with the fine old manor houses and ancient castles cannot fail to appeal to the seeker after the picturesque. One of the charms of the book is that it is no mere guidebook: Sir Frederick has thoroughly mastered the history of the district, and has with rare art interspersed his descriptions with vivid word-pictures of old-time events. We see before us the murder of King Eadward at Corfe Castle by the lovely Elfrida, widow of Edgar: the pomp of his burial at Shaftesbury. Later we have a picture of the siege of Corfe Castle and the gallantry of Lady Bankes. Again the landing of Monmouth is described, his flight and tragic end. In reading the story of his capture, one almost feels the unclean grasp of the yokel on one's collar.

The book is also enriched by the wise observations of one who has seen much of life, and has indeed served his time and generation. The itinerary begins with Shaftesbury, and leaves the reader at Dorchester, and is accompanied by an excellent map, while not the least charm of the volume lies in Mr. Pennell's beautiful sketches.

The Museums and Ruins of Rome. By Walther Amelung and Heinrich Hotzinger. English edition, revised by the Authors and Mrs. S. Arthur Strong, LL.D. Two Volumes. Pp. 326 and 183, with 168 and 96 Illustrations. London: Duckworth and Co., 1906.

No doubt most persons flatter themselves that they can admire a statue without previous study. But to do this intelligently, to grasp the connection that exists between this work of art and other pieces of sculpture, to recognise the special school to which it belongs, and the century in which it was made, requires the guidance of trained experts. These two volumes, profusely illustrated, thoroughly well meet the want. The first volume takes the tourist through the different museums of Rome, beginning with the Vatican, and points out all that is necessary to observe, while gradually initiating him into the proper method of making his observations. A specially useful enlargement, not found in the German edition, is the historical index, in which the various objects of Greek and Roman art are arranged according to the centuries to which they belong.

The second volume deals with the ruins of Rome, beginning with a brief history of the development of the city from the earliest times, and ending with the Christian Basilicas. This volume is also well illustrated, partly with photographs of the buildings as they exist in their ruined state, and partly with probable restorations of the same. Both volumes are handy to carry, being of the same size as a Baedeker.

Summer Rambles. By THOMAS M'KIE. Edinburgh: David Douglas, 1906. *Price 7s. 6d.*

In turning over the leaves of Mr. M'Kie's very readable little volume, we are drawn to contrast these holiday excursions, made by a well-read, observant writer with the more modern point-to-point motor-car tours, the chief object of which seems to be to achieve records. There is the same difference between these two methods of travel as there is between the old-fashioned sportsman working behind his dogs and the more luxurious house party sitting in shelters and having the game driven up by beaters.

We have here the records of many holidays, extending over a number of years, and embracing most of the corners of our country; and we have enjoyed the racy descriptions, mingled with much observation and evidences of varied and extensive reading.

The book is divided into four sections, dealing with the parts of the United Kingdom—Irish, Scottish, English, and Welsh. Naturally, perhaps, the Scottish section bulks more largely than the others, and while it would be difficult to select passages, we think the reader will enjoy the descriptions of Border scenery. The village of Denholm, with the appreciative reference to John Leyden; the Vale of Nith, so dear to Robert Burns; the Pentlands, with their memories of Henry Cockburn and his friends—these are only a few portions selected at random from the store of many good things.

ASIA.

The Garter Mission to Japan. By LORD REDESDALE. London: Macmillan and Co., Limited, 1906. *Price 6s.*

This may truly be said to be a charming book—alike from its fulness of knowledge, from the transparent delight of its author in writing it, and the vivacious simplicity of its method and style. Lord Redesdale (then Mr. A. B. Mitford) was a member of the British Legation in Japan under Sir Harry Parkes about forty years ago. In those days Japan was only beginning to admit foreign influence, and the momentous revolution was being carried through which drove from power the Tokugawa Shoguns, and, restoring the authority of the Mikado, turned him into a real ruler acting through responsible ministers, and has made of the secluded Island Kingdom a world power, which no other State, east or west, can afford to contemn or neglect. Lord Redesdale—as his *Tales of Old Japan*, published in 1871, also attests—saw and knew old Japan. He was personally acquainted and was on terms of friendship with a number of the Japanese statesmen and reformers of the revolutionary period. Thus, returning to Japan in the present year in the suite of Prince Arthur of Connaught, he was able to gauge the changes that have taken place since the revolution. And he now presents us at once with a narrative of the incidents attending the Mission's reception and most hospitable and right royal treatment, and with a description of persons and incidents belonging to his earlier personal experiences. Most interesting are the reminiscences and reflections with which he links together the past and the present; none are more so perhaps than those arising from his meeting again with survivors of the historic past, friends of bygone years. The changes are in many respects marvellous, both politically and socially. Lord Redesdale, as is natural, dwells with deeply sympathetic recollection upon the past. But he is likewise intensely appreciative of the new Japan. He sees among her people the same genius and characteristics at work as of old; and

his book, slight as it may at a cursory glance seem, is in truth a valuable and suggestive study on the actual and possible achievements of genuine national consciousness—soul, as he calls it—even in the East.

It seems ungracious to point to one curious mistake, which has doubtless been ere this brought to the author's notice. On pages 50 and 54 allusion is made to the battle of the Sea of Japan as sealing the fate of Port Arthur. The battle was fought on the 27-28th of May 1905. Port Arthur surrendered on the 7th of January of that year.

Through India with the Prince. By G. F. Abbott. London: Edward Arnold, 1906. *Price* 12*s.* 6*d.*

We cannot altogether congratulate Mr. Abbott on his production. He appears to have been excessively bored by his journey with the Prince—a somewhat misleading title by the way—at least we get a great deal of Mr. Abbott, and as little as may be of the Prince. When he relaxes from this attitude, however, he gives us thumb-nail sketches of native life touched with life and warmth, which leads us to suppose that he could make an interesting volume if he exerted himself, or suffered less from dyspepsia! As a rule he inclines to dwell on the gloomy background of squalor and suffering which is seemingly more in harmony with his mood. It comes as quite a pleasing surprise when he mentions that he fell in love with the inhabitants of the Bikaneer bazaar. The process appears to have been salutary, for his work shows signs of improvement, and the author apparently drops his "Platitudinarian friend" *en route* for Peshawer, at all events he spares us the platitudes for quite a number of pages, and indulges in a really interesting sketch of Indian politics.

"What is truth? said jesting Pilate." We might ask the same question. If for most of us the East is veiled in the mists of illusion, are we to suppose that the naked truth is revealed in these pages, or shall we rather accept the statements of those Easterns who, uniting the culture and education of East and West, yet tell us that in the older civilisation are to be found the fundamental truths of life which are too often forgotten or ignored in the hurry of Western life. Each of us receives just so much from that well as his own cup will hold, but none need accept the cup of another as the measure of the well's depth.

There is much to interest, much that shows intelligent observation, if not deep insight in Mr. Abbott's pages, but we would recommend his readers to study their India elsewhere before forming an opinion as to Eastern life and character, and more especially Eastern religion.

The illustrations are good, and some of them give unusual views of the great Indian towns.

Le Siam et les Siamois. Par Ct. E. Lunet de Lajonquieu. Pp. 358. Paris: Armand Colin, 1906. *Price* 3*f.* 50*c.*

The author, who has already written a description of the monuments of Cambodia, gives in this work an account of Siam and the Siamese, and of a journey which he made in Siam and Burma. He says that the Siamese capital, Bangkok, is one of the great cities of the Far East and the vital point of Siam. Its population is 500,000, and its imports and exports are of an annual value of about £10,000,000. Bangkok's population is a tenth of that of all Siam, which numbers 5,292,000, with, in addition, about 5000 Europeans, Indians, Japanese, etc. The King of Siam calls himself the "Master of Lives," and shares duties and honours with the members of his own family without Board of control or parliament. The King and Princes are, however, assisted by foreign counsellors in the reorganisation

of the various departments of the sovereignty. At the head of these counsellors is a "general adviser," having special charge of foreign affairs, and this official, when the author was in Siam, was an extremely affable American plenipotentiary. The other counsellors are mostly English, and very few are French. The Siamese troops are equipped and instructed after European methods, and the Siamese navy is chiefly commanded by Danish naval officers. Without having recourse to any loan, the Siamese Government has spent about £2,500,000 on railways.

Orthodox Buddhism is the official religion of the country, and there is not a village without its pagoda. The King is the supreme head of religion, and nominates the great ecclesiastical dignitaries, four of whom preside over the different societies of monks and bonzes, and the chief of whom is styled the "Prince of Priests." The author gives a minute description of the life and training of a Buddhist priest, with acknowledgments to an article by Dr. Frankfurter in his *Kingdom of Siam* (Putnam, 1894). Literature in Siam is at a low ebb, and there is no library in Bangkok. Of all Asiatic immigrants the Chinese hold the first place, numbering more than 200,000 in Bangkok, and most of the commerce and many industries are in their hands. Some of them speak English, and their children excel at the schools. They are conscientious in business, and preserve their costume, manners, and religion. With regard to Europeans, the author says there are more than two hundred young European women of all nationalities in Bangkok, and four excellent European Clubs for the men. Recently a "Siam Society" has been formed by some Europeans interested in the language, archæology, and history of Siam. The Siamese are perfectly tolerant regarding religion, and the Roman Catholic missions are the most numerous and prosperous. These missions teach children English, and only a little French, the former language being necessary for trade in the East, and French being of little use there. Neither Roman Catholic nor Protestant missions seem to make converts among orthodox Buddhists, but only among the Chinese and half-breeds.

In Kleinasien. Ein Reitausflug durch das innere Kleinasiens im Jahre 1905. Von Hans-Hermann, Graf von Schweinitz. Berlin: D. Reimer, 1906. Pp. 204. *Price* 6 *marks.*

Crossing the Sea of Marmora in the summer of 1905, the Graf and his wife reached Brussa by railway, and found it to be a town which from its natural beauty, its pleasant climate, and its health-giving springs would make a splendid watering-place. Near Eski Schehir they saw the Meerschaum diggings, which yield annually £50,000 worth of meerschaum. By railway they reached Konia, the ancient Iconium of Cicero and St. Paul, and now a seat of the carpet manufacture, with a population of 45,000. Attended by a guard furnished by the governor of Konia, our travellers now formed a caravan and pushed on to the Lake of Beschehir, a three days' journey from Konia, in tropical heat. They then sailed on the lake, which is a lovely one, partly enclosed by snowy mountains. Another excursion was to the Sogla Lake, and the author indicates how these lakes could be made to irrigate the great waste plain of Konia, and remarks that now that Germans are to aid the Turks in making railways, they must also introduce those irrigation works which the Turks abandoned for want of money. He complains that French, not German, is the official language used on the German railways in Anatolia. With pleasure and surprise, however, he discovered his own country's emblem, a double-headed eagle, on an ancient sculpture at Oejük, and says that this "Wundertier" was regarded as a symbol of the Almighty, and, after appearing in 1217 on Oriental coins, was transferred by the Crusaders to their standards, and thus introduced into Europe. The Oejük double-headed eagle is, he observes,

the oldest specimen known, and may have existed for 4000 years. The volume (which is accompanied by a good map) is very prettily illustrated, is printed in clear Roman type, and is an interesting record of a spirited journey by the author and his wife, whose portrait on horseback forms the frontispiece.

AFRICA.

The Physiography of the Nile and its Basin. By Captain H. G. Lyons. Cairo: National Printing Department, 1906.

This volume contains a very valuable summary of our present knowledge as regards the subject treated, and is well illustrated by maps and plans. At the end there is a bibliography of some length, which should greatly increase the usefulness of the book. As it is professedly a compilation only, and we have within the last few years published a considerable number of articles on the subject, it may be sufficient here simply to draw attention to Captain Lyons' work, and especially to the interesting rainfall maps, which make very clear the cause of the annual rise. In connection with these we note that Captain Lyons emphasises the fact that the old notion that the flood is fed by melting snow must be given up, for very little snow water reaches the Nile at all.

The Native Races of South Africa: A History of the Intrusion of the Hottentots and Bantu into the Hunting Grounds of the Bushmen, the Aborigines of the Country. By George W. Stow, F.G.S., F.R.G.S. Edited by George M'Call Theal, Litt.D., LL.D. London: Swan Sonnenschein and Co., 1905. Pp. 618. Twenty-two plates and one map.

The late Mr. Stow did not live to see his work through the press, so the MS. was entrusted to Mr. G. Theal, than whom no one more competent could have been selected. The author arrived at the Cape as early as 1843, and devoted a great part of his life to studying the native races, trying at the same time to reconstruct their past history, partly from a study of the earliest mention of them by Europeans and partly from native historical legends, some of which have been handed down for at least eighteen generations. He arrived at the conclusion, which has been shared by others, that at no very remote period the Bushmen were the sole occupants of the south of Africa, and that they may be taken to represent the autochthonous inhabitants. Pottery, stone implements, and bones which have become quite fossilised, and may be attributed to these aborigines, have been found in undisturbed beds of sand and marine shells at a depth of sixteen feet. And there is good geological evidence to show that man occupied the country at a remote period when it was far better watered than now, and large lakes existed which are now entirely desiccated. At that time the country swarmed with many species of wild animals, some of which have been exterminated, and others driven far to the north.

In the first twelve chapters are described at length the manners and customs of the Bushmen, and the author gives them a better character than that usually current, for he assigns a great deal of their savagery and cruelty to the ferocious brutality meted out to them by the black and white races that have successively invaded their territory and shot down the big game. He divides them into a western and eastern branch, the former being the Painter tribes and the latter the Sculptor tribes, and brings them down from north of the equator along two routes separated by the Albert Nyanza and the Victoria Nyanza to the Cape. Paintings in caves are found to the west of Lake Tanganyika as far north as the 6° S. latitude.

The next eight chapters are devoted to the history of the Hottentots, Griquas, and Bastard tribes from the time they first came in contact with Europeans. Although in many respects akin to the Bushmen, the Hottentot tribes arrived in the south as a pastoral people, and therefore at a higher stage of civilisation, though that was low enough. The Koranas, for instance, as late as 1827, were only armed with bows and poisoned arrows.

The last six chapters trace the recent bloodstained history of the invasions of the various branches of the Bechuanas and Bantus. It is not altogether pleasant reading. Men who are cowardly by nature and readily fly from danger commit the most frightful atrocities upon helpless captives, or upon women and children, when that can be done with impunity. Thousands of men and women have been murdered, tortured, or have died of starvation as a result of these Bantu conquests. Whole tracts of country are covered with the bleached skulls and skeletons of hapless human beings. On the other hand, some of the Zulus are remarkably brave, and however badly wounded fight to the last. The Bakalahari, too, show no fear of the lion. They form a small party to attack him. As soon as he has sprung some of the men rush forward and seize him by the tail while the others close in and stab him to death with their spears. Towards the end of the volume there is a stirring account of a battle between the Griquas and the Mantatee horde in which 100 mounted Griquas armed with firearms fought 50,000 Kaffirs for several hours, and repulsed them with a loss of about 5000, while they did not lose a man.

AMERICA.

Canada: The New Nation. A Book for the Settler, the Emigrant, and the Politician. By H. R. Whates. London: Dent and Co., 1906.

To any one who has thoughts of sending sons or charges out to the colonies, this should prove both a useful and an interesting book. Mr. Whates gives us knowledge obtained at first hand. He has tested the actual conditions of life in Canada, and gives the result of his personal experience. The net result of his experiment is pretty much what common-sense would lead us to expect; a man of fair physique and average abilities who is willing to go through the mill, take what he can get and make the best of it, has every chance of getting on well and making a competence for himself and his family before he is forty. The conditions of life give a better outlook, a healthier environment, and much greater independence than is possible in the cramped and limited space at home, where practically every acre is already allotted. But it is useless to expect the slack, shiftless, ne'er-do-weel to succeed in Canada when he has failed at home; he will only drift to the cities and sink lower in the company of those like-minded with 'himself, with the added handicap of higher prices for all the necessaries of life. The idle, the intemperate, the physically weak, will stand no better chance of succeeding [than in England—rather the man of good brain power and weak muscles is more likely to get on in the less rigorous conditions of the old country. The labourer and artisan who has grit and patience may, however, hope to attain a position in the new country which he could never reach in the old.

The illustrations in the volume are good.

AUSTRALASIA.

Geography of New Zealand. By J. A. M'Donald. Gordon and Goteh Proprietary, Ltd., Wellington and Christchurch, N.Z., 1903. *Price* 1*s.* 6*d.*

Mr. M'Donald has packed into this little volume of about a hundred pages as

much as they will hold about the geography of New Zealand. The manual may be useful as a crammer for "senior pupils, scholarship candidates, and pupil teachers." It has no attractions for the general reader.

Through the New Commonwealth. By WILLIAM REDMOND, M.P. Dublin: Sealy, Bryers and Walker, 1906.

This brief sketch of impressions received during a recent tour in Australia by Mr. W. Redmond, the well-known Irish M.P. for East Clare, is obviously intended in the first instance for Irishmen who are Home Rulers and Catholics. It is for the most part frankly political, and thus cannot be reviewed in the ordinary way in this *Magazine*. It adds nothing to our knowledge of Australia, but it incidentally indicates some good reasons to the average Irish emigrant why, when emigrating from Ireland, he should not choose Australia as his future home.

GENERAL.

Geographical Gleanings. By the Rev. FRANK A. BURROWS, M.A. London: George Philip and Son, Ltd., 1906. *Price* 1*s.* 6*d.*

The Rev. Mr. Burrows has done well to republish a very useful and instructive lecture, which he delivered some ten years ago at the Hastings and St. Leonards College for Ladies. In it he deals with "the methods of teaching geography, and the preparation and teaching of the subject," and he shows that a successful teacher of geography must possess a thorough knowledge of astronomy, geology, botany, zoology, and anthropology, as well as geography in the more limited sense. He has some most judicious advice on the advantages of the use of globes, maps, diagrams, etc., with which to elucidate the subject and impress it on the student's mind. The lecture is well worth the attention of others than teachers.

Our Planet. The "Round the World" Series. London: T. C. and E. C. Jack, N.D. Pp. 256.

This is on the whole a useful general sketch of the physiography and physical geography of the earth. Some improvements might be made; for instance, there are one or two mistakes in the figure on p. 15, curiously entitled, "The Earth's Orbit and the Ecliptic, and their corresponding planes." Perhaps the least satisfactory part of the book is the chapter on map projections.

A Complete Pronouncing Gazetteer or Geographical Dictionary of the World. Edited by ANGELO HEILPRIN, of the Sheffield Scientific School of Yale University, etc., and LOUIS HEILPRIN, author of "The Historical Reference Book." London: J. B. Lippincott Company, 1906. Pp. 2053.

The new edition of this Gazetteer is practically a new compilation. The articles, necessarily short, are well written, containing all the most important details, and are in general very accurate. Under "Sudan, Egyptian," there is indeed a somewhat serious error. There is no "direct railway communication between Khartum and Cairo," for the construction of the section between Wady Halfa and Aswan is not, as far as we are aware, even contemplated at present. The railway from Berber to Suakin and Port Sudan should have been mentioned.

The pronunciation of names is a very useful feature of the book. The pronunciation of Keighley, Fowey, Milngavie, Scone, and other places, not very generally known, is correctly given, but Nantwich (Cheshire) is pronounced as spelt—not *nant'ich*. In Russian names the vowels are not always preceded by

the *y* sound, never after a sibilant, and the sound *th* still survives in Iceland. Urga (Mongolia) is *ürga*, not *oorga*.

Sociological Papers. Volume II. Published for the Sociological Society. Pp. 307. London: Macmillan and Co., 1906.

The distinguished authors who unite their efforts to clarify our ideas and extend our knowledge in the difficult field of Sociology demand our fullest sympathy and support. Yet it is impossible in the small space allotted to the notice of non-geographical works to do more than give the titles of the subjects discussed by the learned authors. The volume opens with a paper on "Eugenics," by Mr. Francis Galton, followed by another on "Civics," by Professor P. Geddes. Professor Sadler writes upon "The School in some of its Relations to Social Organisation and to National Life"; Dr. Westermarck on "The Influence of Magic on Social Relationships"; Professor Hoeffding "On the Relation between Sociology and Ethics"; Dr. Bridges on "Some guiding Principles in the Philosophy of History." The three concluding papers on "Sociological Studies" are contributed by Mr. Stuart Glennie. The interesting discussion which followed each paper is given in full, and also the author's reply to the criticisms.

Die Territoriale Entwicklung der Europäischen Kolonien. Mit einem Kolonialgeschichtlichen Atlas von 12 Karten und 40 Kärtchen im Text. Von Dr. Alexander Supan, Herausgeber von Petermanns Mitteilungen. Gotha: Justus Perthes, 1906. Pp. 344. *Price* 12 *marks*; *bound*, 12.50 *marks*.

The territorial expansion of European colonisation is now practically at an end, all parts of the world being portioned out by treaties among the recognised governments of the earth, though some few tracts have not yet been brought under administrative control, and a few frontiers have yet to be regulated. The present is therefore a period at which the progress of European colonisation may most appropriately be reviewed, and the varying fortunes of the great colonising powers may be traced, resulting at last in the existing distribution of the colonisable lands. As the author remarks, no such general history has been hitherto compiled, and, indeed, few writers, if any, are so well able to undertake the task.

A short account is first given of the early beginnings of colonisation in Iceland and the Canaries, and then the subject is treated of in four great periods, namely, the Spanish and Portuguese period from 1492 to 1598; the Dutch period 1598-1670, during which Holland extended its colonial empire in the Eastern Archipelago and in America; the French and British period, 1670 to 1783, in which France established settlements in India, extended its possessions in North America, and acquired Cayenne, several West India islands, etc., and lost most of these acquisitions by the end of the period, while Great Britain founded its Indian Empire, took Canada, and lost the United States. The British and American period, 1783-1876, is marked by the expansion of the United States to the Pacific Ocean, the colonisation of Australasia, the enlargement of the Indian empire, the revolt of the Spanish colonies in America, etc., while the last period is chiefly remarkable for the opening up and partition of Africa. Each of these periods is again subdivided, and each subdivision is accompanied by a map, showing the distribution of European colonies at the concluding date.

The history of these movements is clearly related in the text, and the causes which led to the acquisition or loss of territory—political, commercial, etc.—are briefly alluded to. The final chapter deals with the colonies of the present day, their area and population, divided into immigrant colonies, native territories, the

development of which must depend on their original inhabitants, and mixed colonies. This is illustrated by a map showing the progress of European colonisation, which would have been clearer if the periods had been indicated by different colours instead of shades of red.

The work is an excellent and useful summary of facts, well arranged, and will no doubt be accepted as a standard book of reference. The divisions seem to correspond well with the historical facts, though probably opinions will differ on this point. The author himself does not regard his choice as unimpeachable.

A Progressive Course of Comparative Geography. By P K L'Estrange B.A. Demy 4to. With 69 Coloured Plates. London : G. Philip and Son, 1906. *Price 6s. net.*

This book is a new departure in geographical teaching. It is designed to comprise a complete school course occupying six years. There are advantages and disadvantages in being bound to one text-book for the whole course. It ensures covering the whole ground, and also more systematic study, but for advanced pupils a certain variety of treatment is perhaps more suggestive and stimulating to the mind. As to the merits of the work itself, we have nothing but praise. It fully realises the author's aim to train the pupil to think rather than store his memory with simple facts, hence details have been avoided except in illustration of general principles. The course is divided into six parts. Part I. deals with the Principles of Geography, Polar Regions, and General World Facts ; II. British Isles ; III. Europe ; IV. North America and Asia ; V. Central and South America and Africa ; VI. The British Empire. Each part is divided into three sections : (*a*) to be taken by the lowest section of the school ; (*b*) by the middle ; and (*c*) by the upper. The whole ground is thus covered three times, but in each revision a wider and more scientific view of the subject is imposed. The admirably executed maps and illustrations are not merely supplementary, but form an integral part of each lesson. Carefully considered questions and exercises ensure a thorough comprehension of the lessons. Altogether the book represents an advance in the teaching of Geography, and deserves the attention of teachers.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Things Seen in Japan. By Clive Holland. Crown 8vo. Pp. 252. *Price 2s. net.* London : Seeley and Co., 1906.

Spain and Her People. By J. Zimmerman, LL.D. Demy 8vo. Pp. 350. *Price 10s. 6d. net.* London : T. Fisher Unwin, 1906.

Kinglake's Eothen. With an Introduction by D. G. Hogarth. Crown 8vo. Pp. xxiv + 295. London : Henry Frowde, 1906. *Price 2s. 6d. net.*

The Voyage of the "Scotia" : Being the Record of a Voyage of Exploration in Antarctic Seas. By Three of the Staff. With Illustrations. Demy 8vo. Pp. xxiv + 375. *Price 21s. net.* Edinburgh : William Blackwood and Sons, 1906.

Western Tibet and the British Borderland : The Sacred Country of the Hindus and Buddhists, with an Account of the Government, Religion, and Customs of its Peoples. By Charles A. Sherring, M.A., F.R.G.S. With a Chapter by T. G. Longstaff, M.B., F.R.G.S., describing an attempt to climb Gurla Mandhata. With Illustrations and Map. Royal 8vo. Pp. xv + 367. *Price 21s. net.* London : Edward Arnold, 1906.

The Todas. By W. H. R. Rivers. Demy 8vo. Pp. xviii + 755. *Price* 21*s. net.* London: Macmillan and Co., 1906.

Life and Adventure Beyond Jordan. By the Rev. G. Robinson Lees, B.A., F.R.G.S. With Illustrations and Photographs by the Author. 8vo. Pp. 304. *Price* 5*s. net.* London: Charles H. Kelly, 1906.

Lotus Land: Being an Account of the Country and the People of Southern Siam. By P. A. Thomson, B.A., A.M.I.C.E. Demy 8vo. Pp. xii + 312. *Price* 16*s. net.* London: T. Werner Laurie, 1906.

The World's Commercial Products: A Descriptive Account of the Economic Plants of the World and of their Commercial Uses. By W. G. Freeman, B.Sc., F.L.S., and S. E. Chandler, D.Sc., F.L.S. Part I. *Price* 7*d.* (complete in twelve fortnightly parts). London: Sir Isaac Pitman and Sons, Ltd., 1906.

The Rhine from Rotterdam: Handbook to Travellers. By Karl Baedeker. With 52 Maps and 29 Plans. Sixteenth Edition. Pp. xxxiv + 461. *Price* 7 *marks.* Leipzig: Karl Baedeker, 1906.

A Scientific Geography. By Ellis W. Heaton, B.Sc., F.G.S. Book II. The British Isles. Crown 8vo. Pp. 137. *Price* 1*s.* 6*d. net.* London: Ralph, Holland and Co., 1906.

The Oxford Geographies. By A. J. Herbertson, M.A., Ph.D. Vol. I. The Preliminary Geography. Crown 8vo. Pp. viii + 149. *Price* 1*s.* 6*d.* Oxford: Clarendon Press, 1906.

Geography of the World. Book VII. The New Century Geography Readers. Crown 8vo. Pp. 320. *Price* 1*s.* 9*d.* London: Blackie and Son, Limited.

Coloured Handbook to Kindergarten Geography designed as a Guide to Junior Teachers. By Geo. T. Lodge. *Price* 1*s.* 6*d. net.* Nottingham: Sisson and Parker, 1906.

Geography by the Eye: Memory Maps and Geographical Text-Book in One. Three sets. Packets of 24. *Price* 1*s. each.*

Kindergarten Geography: Maps to Outline and Colour. Three sets. Packets of 24. *Price* 6*d. each.* Nottingham: Sisson and Parker, 1906.

Hawaii, Ostmikronesien, und Samoa. Von Professor D. Augustin Krämer. Pp. xvi + 581. Stutgart: Strecker and Schröder, 1906.

The Polish Jew: His Social and Economic Value. By Beatrice C. Baskerville. Demy 8vo. Pp. 336. *Price* 10*s.* 6*d. net.* London: Chapman and Hall, 1906.

M'Dougall's Geographical Readers: Our Own and Other Lands. Crown 8vo. Pp. 224. *Price* 1*s.* 3*d.*

M'Dougall's Concentric Geographies. Five parts.

M'Dougall's School Atlas: Coloured and Photo-Relief Maps. Price 6*d. net.* Edinburgh: M'Dougall's Educational Co.

Also the following Reports, etc.:—

Brown's Comprehensive Nautical Almanac, Harbour and Dock Guide and Advertiser and Daily Tide Tables for 1907. Demy 8vo. Pp. 524. *Price* 1*s. net.* Glasgow: James Brown and Son, 1906.

Report on the Administration of Bengal during 1904-1905. Pp. 148. *Price* 4*s.* 6*d.* Calcutta, 1906.

Cyprus Blue Book, 1905-1906. Nicosia, 1906.

Annual Report of the Geological Survey of Canada. Volume XIV. 1901. Ottawa, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

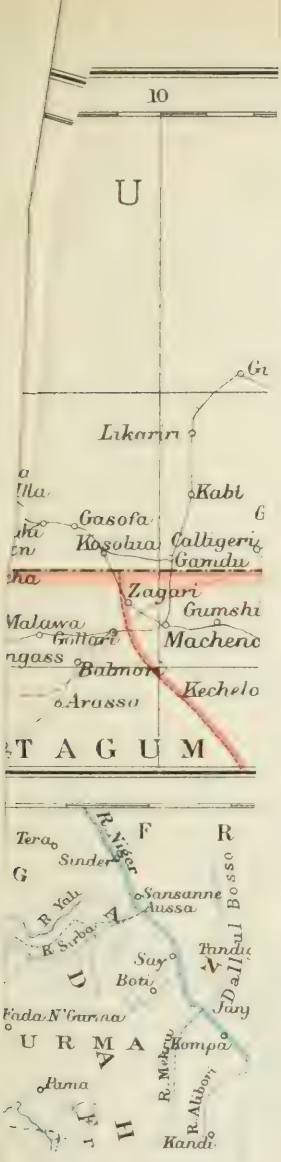
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FIG. 1.—The Railways of West Africa.

In Togoland the Germans constructed, in 1902, a line of 26 miles from Lome, which will be extended to Atakpame, 196 miles inland, and the British, between 1897 and 1903, a railway in Gold Coast Colony, from the port of Sekondi to the capital, Kumassi, a distance of 465 miles. This railway has already proved of great use to the Colony. About the same time a railway was constructed in Sierra Leone, from Freetown to Bo, nearly 76 miles in length.

The object of the French Colonial Office during the past thirty years has been, according to M. Jacob, to acquire command of the valley of the Niger, and the proposal to connect Algeria with Senegal and Lake Chad aroused, he tells us, "un enthousiasme africain." Similarly, a railway through Dahomey to the Niger has been projected, but as yet extends only 118 miles inland from the port of Kotonu. It is, however, being prolonged to Paraku, 156 miles further inland, with the object of extending it to the Niger, near the British frontier of North Borgu, from whence it will acquire the trade, not merely of Dahomey, but also of Borgu, Sokoto, and Gando.

As large a sphere of railway enterprise opened in the French Ivory Coast, and, being authorised in 1903, a railway of 49 miles was constructed from the port of Abidjean to Erimakuguie, which will be carried to Kuadiokoffi (161½ miles). In French Guinea the Government in 1900 began a railway which was to unite the Niger with the port of Konakry, and thus prevent traffic going through the British Colony of Sierra Leone to Freetown. The line has already been made from Konakry to over 124 miles from the coast, and in a few years Kurussa on the Niger will be reached. In Senegal a railway was constructed between Dakar and Saint Louis, 176 miles long, and from Kayes on the Senegal to Bammako on the Niger, nearly 311 miles in length, with an extension to Kulikoro, 37 miles down the Niger. To complete these lines, a railway has been projected from Dakar to Kayes, and another from Bammako through the Sudan to Niamey on the Niger—a vast project proving how thoroughly the French believe in African railways.

Algerian Railways.

M. Jacob states that in 1830 there was not in Algeria even a road, there being only Arab paths scarcely wide enough for a horseman. Rivers were of no use for transport. The first roads were constructed by the military authorities, and the original programme of Algerian railways was not drawn up officially till 1857, when a decree was issued at the instance of Marshal Vaillant. In 1862 the line from Algiers to Blida was opened for traffic, and after that the other lines which ramify through Algeria were gradually constructed.

Railways followed the contour and agricultural resources of Algeria, whose trade is mainly derived from agriculture, although there is also a mining industry there, still, unfortunately, poorly developed. The chief railway system runs nearly parallel to the coast from the frontier of Tunisia to that of Morocco, and was extended in 1881 to Tunis.

There are thus about 988 miles of railways from Goletta-Tunis to Tlemsen, near the Moroccan frontier.

Again, each of the plains or valleys of the coast region required to be connected with a seaport, which was at once its market for provisions and its commercial outlet. Thus, railways were constructed from Gelma to its seaport Bona, from Constantine to Philippeville, from Beni Mansur to Bougie, from Tiaret and Relizane to Mostaganem, from Perregaux to Arzeu, and from Ain Temuchent to Oran, with the additional lines of Tiziuzu, Blida Berruaghia, and Bona Saint-Charles. These railways work by far the richest part of Algeria, yielding good freight, cereals, fruits, forage, wine, and sometimes minerals, such as the phosphates of Tebessa. They have also most passenger traffic.

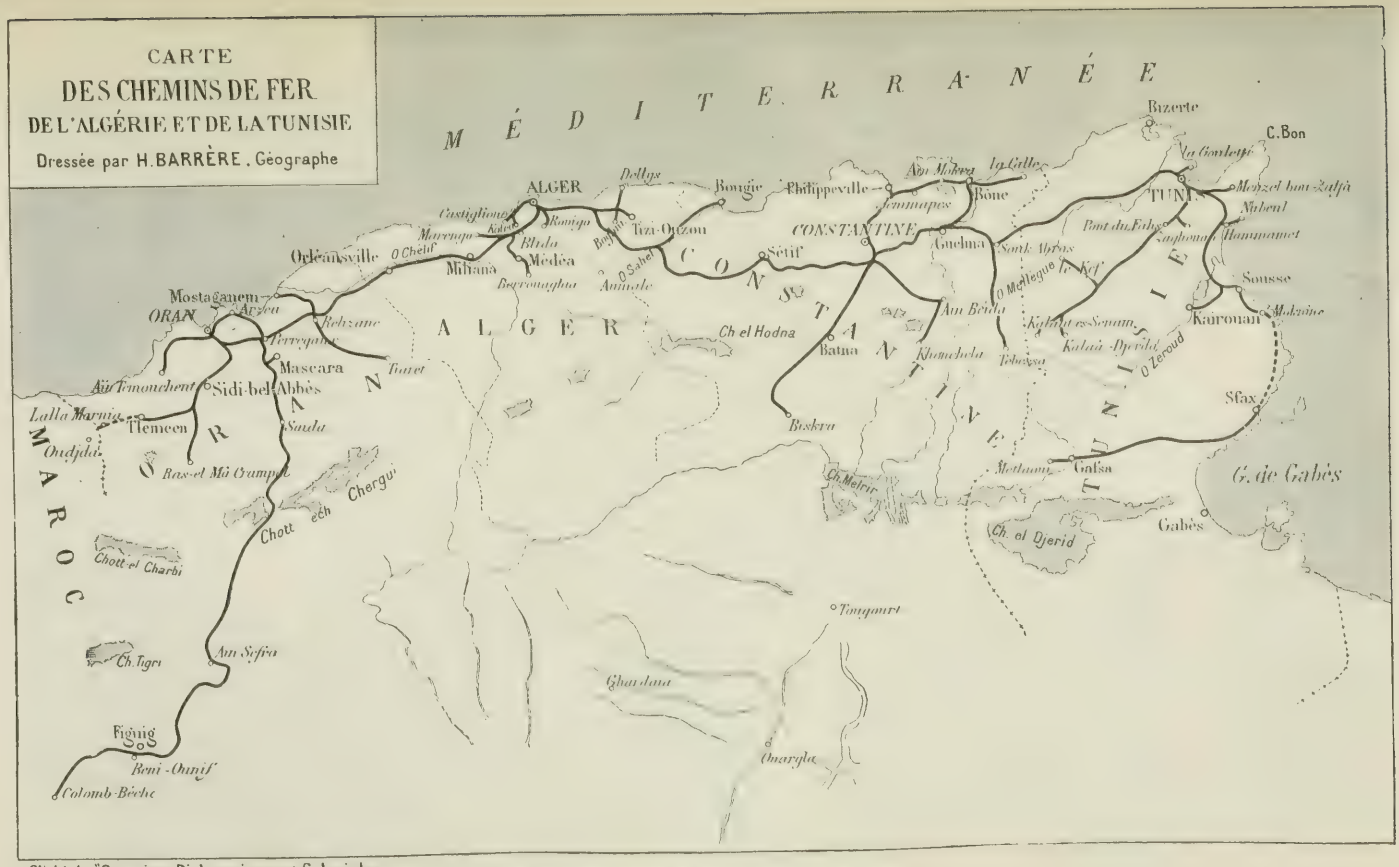
Although the high plains are generally less valuable, it was considered useful to afford means of transport to their cattle-rearing districts, to their alfa industry (south of Saida), and their palm groves (Biskra). The uplands of the extreme south, especially the south-west, of Algeria have been always inhabited by the most intractable natives, and thus, for political and strategical reasons, means of rapid communication were necessary. Besides, it was profitable to unite the coast region of the Tell with the oases of the Algerian Sahara, Figuig, El Golea, Gardaia, Wargla, and Tugurt, where date plantations have been so marvellously developed, and where the traditional manufacture of carpets and fabrics employ several thousands of artisans. By such lines it was hoped to enrich the Mediterranean ports with the commerce of the caravans of the desert and the Sudan, to increase the attractions of a trans-Saharan line, and to introduce by way of Figuig the dominating influence of France over Morocco. These were the reasons why these lines of penetration were constructed.

By the law of 29th December 1903 a continuation of the railway from Tlemsen to Lalla Marnia on the Morocco frontier was authorised, and from there it could be pushed on perhaps some day westwards towards Fez, Mequinez and the Atlantic.

Tunisian Railways.

Nearly midway between Bona and Tebessa the railway leaves Algeria and proceeds to the city of Tunis, from which a line leads to the great military port of Bizerta, and another to Carthage and to Goletta, at the entrance of the canal by which even large steamers reach Tunis. Other lines proceed from Tunis to Kalaat-es-Senam, in the Tunisian Hinterland, and along the East Coast to Susa and Kairuan. A line from Metlaui and Gafsa to the port of Sfax will be continued along the coast till it meets the line to Susa.

Thus Tunisia may be said to be ramified with railways. M. Jacob remarks as a curious fact that the most of the new Algerian and Tunisian railways have been constructed for the development of mineral fields. "It is a striking proof," he adds, "of the development of mining in our barbarian possessions, which were formerly exclusively devoted to agriculture." This mineral traffic has imparted new life to the seaports



Cliché des "Questions Diplomatiques et Coloniales

FIG. 2. – The Railways of Algiers and Tunisia.

of Algeria and Tunisia. For example, the minerals brought by railway to Bizerta assure the prosperity of that port by furnishing its shipping with a return freight, while as a coaling station for the French navy the future value and existence of Bizerta depend upon its being connected by railway with the coalfields of Tunisia.

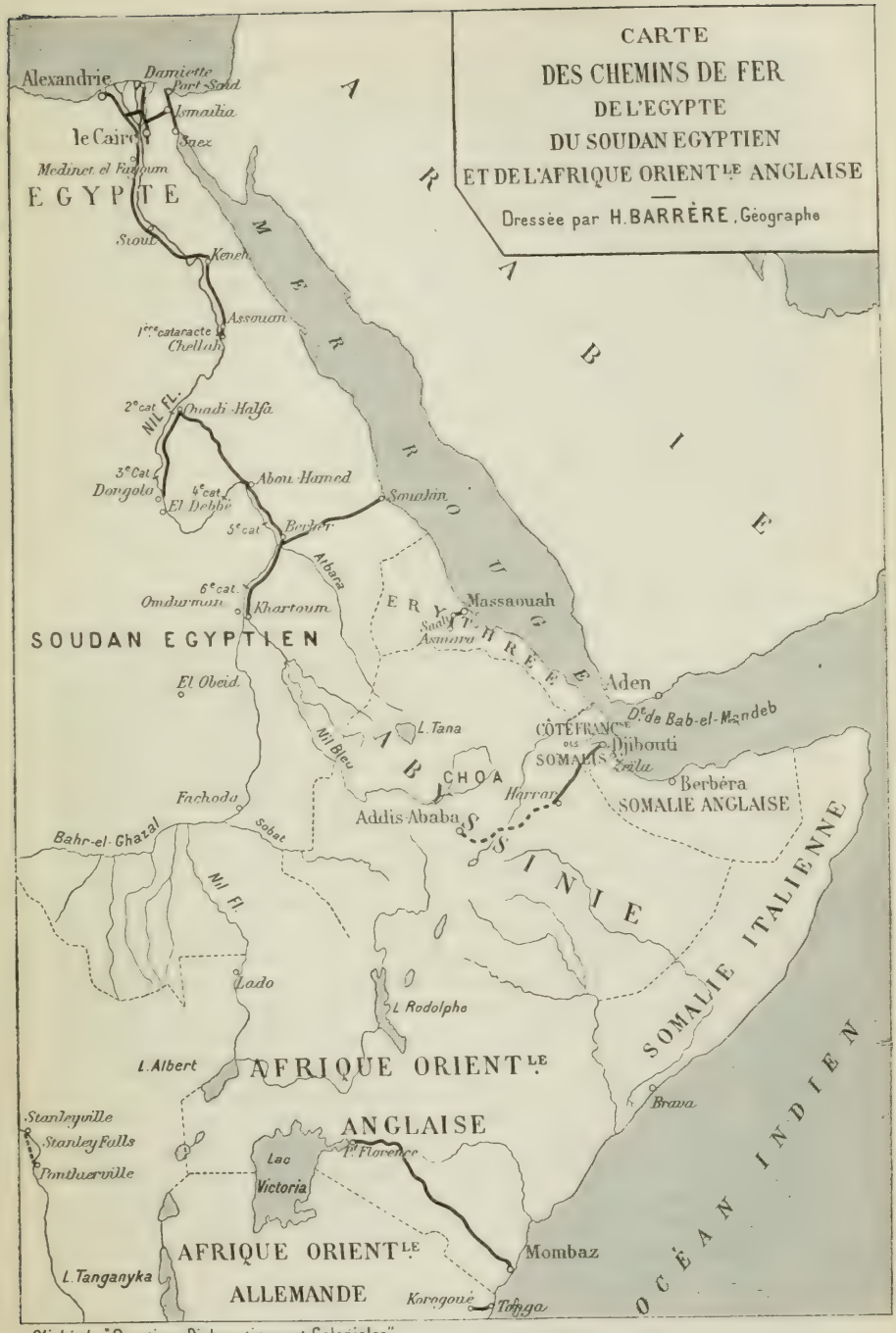
Egyptian Railways.

The first Egyptian railway, that from Cairo to Alexandria, was commenced so long ago as 1852, when Abbas was ruler, and was completed under Said in 1856. But it was not till 1874, under the Khedive Ismail, that it was pushed southwards, first to Medinet El Fayum, then to Siut. At the same time, the two lines from Cairo to Damietta and to Suez *via* Ismailia were constructed. All these lines were nearly entirely made by Egyptian engineers and capital. To them was added the light railway from Ismailia to Port Said, and the continuation in 1897 of the Nile railway to Keneh, which was afterwards carried on to Assuan and above the First Cataract, at Shellal. As the British occupation and administration of Egypt commenced in 1882 and have continued ever since, the latter important prolongations are due to British enterprise.

Egyptian Sudan and Abyssinian Railways.

Although Ismail Pasha in 1875 began a railway from the Second Cataract at Wady Halfa to Metammeh above the Sixth Cataract, lack of funds and the Mahdist insurrection put a stop to the works. When the British succeeded to power they quickly perceived that the economical outlet of the Egyptian Sudan was not Alexandria, some 1600 miles from Khartum, but rather Suakin, under 250 miles as the crow flies. They also saw in a line from Suakin to the Nile a means of communication between India and Egypt which would be useful if the Suez Canal were obstructed. In order to quell the Mahdist rebellion, and to facilitate Lord Kitchener's advance, a railway was constructed from Wady Halfa to Abu Hamed and eventually to Khartum. At the close of 1899 Lord Kitchener, victorious at Omdurman, entered Khartum, and the railway station there was opened on the 4th January 1900. Thus, nearly 700 miles of railway with a gauge of 3 feet 6 inches had been laid in a little more than three years. Simultaneously the line abandoned by Ismail Pasha above Wady Halfa was reconstructed and pushed on to Dongola, thus bringing the whole region of Darfur within easy reach of Egypt.

On the 26th January 1906, Lord Cromer officially inaugurated the "Nile to Red Sea Railway," some 330 miles in length. At first Berber on the Nile was suggested as starting-point, but the junction of the Atbara with the Nile was preferred. This railway, says M. Jacob, is "a veritable bridge thrown across the desert, and it brings life once more to a country which the Mahdist rebellion had desolated. It will convert Khartum and Omdurman into great cities, and it will create a new port on the Red Sea. Britain acquired from Egypt the port of Suakin, but it has been abandoned on account of its difficult access, its small



Cliché des "Questions Diplomatiques et Coloniales"

FIG. 3.—The Railways of Egypt, the Egyptian Sudan, Abyssinia, and British East Africa.

harbour, and its unhealthy climate. To replace it, the bay of Sheik el Bargut has been chosen, 30 miles north of Suakin, a bay which is secure and spacious, with deep water and a less torrid climate. Three thousand workmen are engaged there making it the Port of the Sudan, and hence the name it has received of 'Port Sudan.' The only fault of this port consists in a line of breakers which stretch along the shore for 15 miles, but a lighthouse has been erected which will facilitate an entrance. A prosperous future awaits the new town so happily situated on the route from Europe to India." The Sudan Government is now advertising for tenders for about four hundred building sites at Port Sudan to be held on building leases for eighty years from 1st January 1907.

According to statements made by Lord Cromer the Suakin branch is likely to be continued to Kassala on the Abyssinian frontier, and to El Obeid in Kordofan. The Abyssinian monarch Menelik agreed with the British Government on 15th May 1902 that a railway should connect the Sudan with Uganda, and this line is being surveyed. He also authorised a railway to be constructed from Jibuti on the coast to his capital Adis Ababa, and 185 miles are open.

British East African Railway.

Uganda is a fertile region where indiarubber, gums and agricultural products abound, but a great portion of British East Africa participates in the volcanic nature of the African tableland and is covered with infertile lava-beds and eruptive rocks. To Britain, however, this territory was of exceptional importance, for its possession enabled her to put down Mahdism both in the Sudan and in the south of the Nile valley, and thus assure the security of Egypt. A railway would permit her to concentrate rapidly her troops coming from India, either against Abyssinia or a new Mahdi, if ever this was necessary. So in 1891-92 Major Macdonald was instructed to survey a railway line from Mombasa to the Victoria Nyanza, and in May 1896 its construction commenced. Great difficulties were met with as the natives would not work on the line, and Indian coolies had to be employed, there being no fewer than twenty thousand in 1900. They suffered from the climate and want of water, and also from fever, and many perished. Transport animals died from the tse-tse fly, and torrential rains frequently stopped the work. The line had to rise from the sea-level to heights of 7000 feet, and then descend to 3000 feet near Lake Victoria. Yet in 1901, after immense toil, the railway, 600 miles in length, reached Port Florence on that lake. It cost nearly six millions sterling, and will long remain a splendid Imperial achievement, although not a dividend-paying concern. M. Jacob does not add that the shareholders of the public-spirited British East African Company, which made this railway, received from the British Government, when it purchased the railway, only one half of the par value of their shares.

German East African Railway.

"The Germans," remarks M. Jacob, "but lately become colonisers, have acquired in Africa enormous territories. They are extremely slow

in turning them to account." Railways were projected to the three Lakes, Victoria, Tanganyika, and Nyassa, and the German press endeavoured, but unsuccessfully, to make the people of Germany enthusiastic regarding them. Thus all these great railway schemes have come to nothing. A private company began a line and would have failed but for the intervention of the German Government, and the joint result is the line from the port of Tanga to Korogwe, about 80 miles long, and which cost nearly a quarter of a million sterling. "It is curious to observe," says M. Jacob, "that Germany, which during the last thirty years has furnished such a spectacle of industrial and commercial progress, should refuse to admit that railways are essential to the development of her African possessions." Seeing that the French have made no railways yet in their vast and fertile Congo territories, this criticism loses its edge.

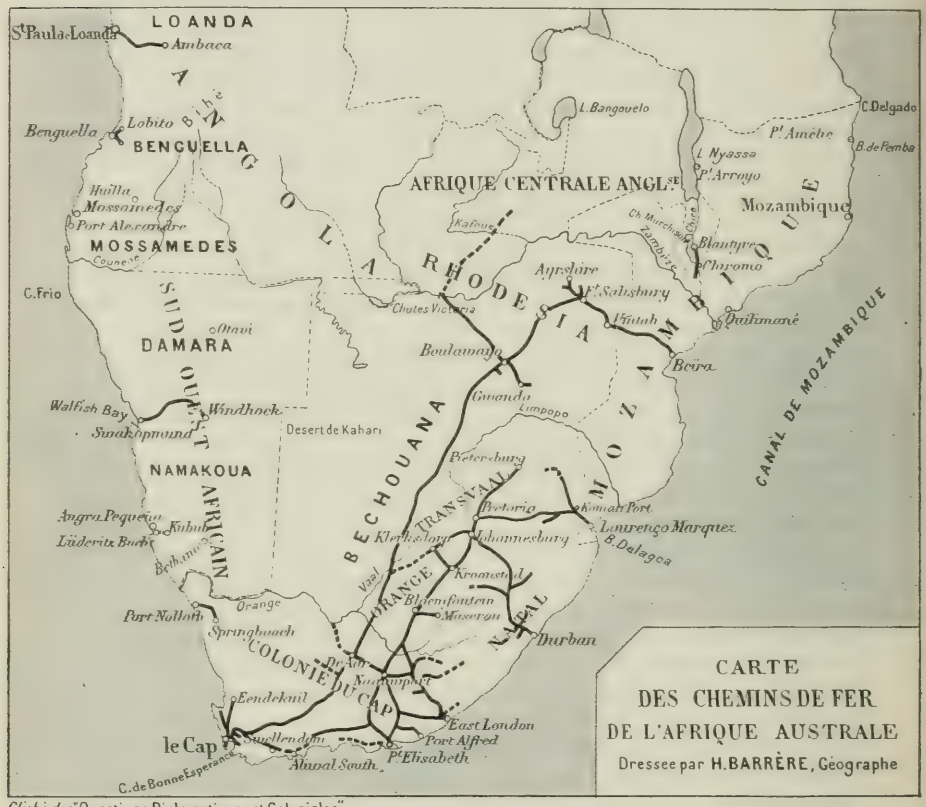
South African Railways.

Beginning with Mozambique, M. Jacob points out that a British company has projected a line connecting the Portuguese Port Amelia on the Bay of Pemba, with Porto Arroyo on the Nyassa, which would drain the traffic from that lake. Another British company is constructing a line some 187 miles long to unite the Nyassa with the navigable portion of the Shiré by avoiding the Murchison rapids. Sir Alfred Sharpe has estimated that this line will enable thousands of natives presently employed by transport companies to be transferred to agriculture and the cultivation of coffee, which will become one of the richest products of the Colony. This line may eventually be pushed on to Quilimane or Beira on the sea-coast.

Beira is one of the towns of the future of Mozambique, and is already one of its chief seaports, possessing as it does the only good harbour on a swampy coast. It derives its importance, however, from the British possessions in its vicinity, for a line proceeds from it for 204 miles into the interior and reaches the British frontier at Umtali, thus connecting it with Matabele and Mashona lands. This line was constructed by British companies affiliated to the great British South African Company of Cecil Rhodes. "In 1891 Beira was only a fortified hamlet on the coast with scarcely seven hundred inhabitants, without either commerce or industry, but now, thanks to its British Hinterland, it has over 5000 inhabitants, marine quays, harbours, lighthouses, great commercial houses, banks, steam tramways, and electrical works. In 1904 more than three hundred ships made it a place of call."

The same circumstances have been the making of Lorenzo Marquez. It was not till 1885-89 that, after many political and financial vicissitudes, the 55 miles separating the sea-coast from the Transvaal frontier were covered by a railway. Then five years more (1889-94) were required to reach Pretoria. Although President Kruger perceived the commercial advantages of railways, he feared their political effect. He always suspected methods of reaching the Transvaal too easily, and remarked, "Waggons bring us a hundred Britishers weekly, but Railways will bring us a thousand."

The Lorenzo Marquez Railway is now a British concern, and only 55 out of 348½ miles are on Portuguese territory. The line would be valueless but for the rich regions behind of Pretoria and Johannesburg, and for its connection with the network of South African railways. Thanks to it Lorenzo Marquez has become one of the principal towns of Africa, with 16,000 inhabitants. A new line has been surveyed from



Cliché des "Questions Diplomatiques et Coloniales"

FIG. 4.—The Railways of South Africa.

Lorenzo Marquez to Pretoria, which would be shorter than the existing line by 60 miles.

"Britain is the chief Power in South Africa, and her territory there is at once the most extensive and valuable and the best developed. Egypt excepted, she was the first to introduce railways into Africa, for the Cape of Good Hope had railways before Algeria. In 1859 the line from Cape Town to Wellington, 58 miles, was opened. But, however enterprising the British were as pioneers, the Cape railway system was developed but slowly. The climate encouraged both population and cultivation, but the structure of the land opposed, as in Algeria, the

construction of railway lines into the interior. The South African tableland descends to the sea by a series of mountainous steps separated from each other by numerous and generally parallel chains." No one imagined that the interior of the Continent possessed vast riches till, in 1869, the "Southern Star" was found near Kimberley. Next year great beds of diamondiferous blue clay were discovered between the Orange and the Vaal. This discovery revolutionised the economic situation of the country and gave it an immense impulse. The rush of emigrants to Cape Colony recalled the traditional rush to California in the middle of last century, and railways were constructed which enabled Britain to take possession of the interior.

The discovery of the goldfields of the Transvaal increased the excitement of immigration. Railways became necessary, and particularly by the energy of Cecil Rhodes and the British South African Company, which he directed, the great line of Rhodesia reached Mafeking, and afterwards Bulawayo. Even in the then independent States of Orange and the Transvaal railways were made, in spite of President Kruger's apprehensions, by the influence of British immigrants. It would take too long to tell of the construction of each successive line. It suffices to say that there are more than 6200 miles of railway in South Africa to-day.

There are two great South African lines, one extending from Cape Town to Beira by Kimberley, Mafeking, Bulawayo, and Salisbury, over 2100 miles in length, and the other from Port Elizabeth to Lorenzo Marquez by Bloemfontein, Johannesburg, and Pretoria, nearly 1000 miles in length. From these trunk lines various branches proceed, such as from Cape Town to Malmesbury, Piquetberg, and Eendekuil (129 miles); from Cape Town to Swellendam, extended to Riversdale in July 1905; from Port Elizabeth to Port Alfred; from Bloemfontein to Moddersport and Maseru (Basutoland); and from Johannesburg to Kleerksdorp. Other branches connect the Port Elizabeth and Lorenzo Marquez line with the chief ports of the East Coast, such as the branches from Naauwport to Port Alfred and Port Elizabeth, Springfontein to East London, Johannesburg to Durban, and extensions such as the branch to Bethlehem in Orange River Colony, and lines along the coast.

There is, however, only one line connecting the two great trunk lines, viz., that proceeding from De Aar to Naauwport, and the different seaports are not connected with each other by a coast line, so that there is no direct communication between Cape Town, Bloemfontein, and Pretoria, and it is necessary to make a long detour in order to go from Durban or East London to Cape Town. The Cape Government, which controls a large part of the South African railway system, has for years been endeavouring to remedy this state of things. Pending the construction of more direct lines it has provided direct trains with sleeping cars running from the quay at Cape Town *via* De Aar and Naauwport to Bloemfontein and Pretoria.

A new line connecting Cape Town with Pretoria is in course of construction *via* Warrenton, Kleerksdorp, and Johannesburg. A branch connecting the two trunk lines will go from Kimberley to Springfontein

and assure rapid communication between Port Elizabeth, East London, Kimberley, and Rhodesia. A third line will connect the Transvaal with Rhodesia by Krugersdorp and Rustenburg, the portion from Johannesburg to Lobati being in course of construction. The coast towns are also to be united by new lines. The two sections from Cape Town to Swellendam and from Aliwal South to Port Elizabeth are to be connected, and will form a sort of Great Central of the Cape. From Kleerksdorp a branch *via* Kroonstadt will join Bethlehem and go straight to Durban, while from Bloemfontein another branch will reach Bethlehem *via* Moddersport. It is proposed to shorten the route from Johannesburg and Pretoria to Lorenzo Marquez, and the Northern Transvaal will be directly connected with the sea-coast by a line from Pietersburg to Lorenzo Marquez.

Finally, in the Northern British territories the great line of Rhodesia is being carried further and further north. The Directors of the Chartered and all the Imperialist party follow this extension with the deepest interest, for is it not the southern extremity of the famous Cape-to-Cairo Railway? The line proceeds from Bulawayo to the Victoria Falls on the Zambesi, the bridge across that river having been opened on 11th September 1905. In January last the rails were laid to the Kafue river, nearly 250 miles beyond the Victoria Falls, and the engineer, Sir Charles Metcalfe, estimated that they could be laid at the rate of 1750 yards, or nearly a mile, a day. "On one occasion," said he, "we laid above 437 yards of rails in twenty minutes." On 7th June last the line had reached 358 miles further north than the Victoria Falls, at Broken Hill station.

This line possesses a commercial value in addition to the political interests to which it owed its birth, for it traverses near the Zambesi the rich coal-basin of Wankie, which produces coal almost equal to the best in England and already supplies the locomotives of the line. Again, in North Rhodesia the valley of the Kafue, now reached by the railway, contains important deposits of copper, zinc, and lead. Coalfields seem prevalent throughout all the Zambesi basin, and the coal-mines of Gwanda, to the south-east of Bulawayo, were deemed of such importance that a line over 124 miles long was laid to connect them with Bulawayo. This line is being extended in the direction of Pietersburg, and doubtless the day is not far distant when Gwanda and Pietersburg will be connected by railway.

An iron network has thus been cast across South Africa, and it is the largest on the African Continent, for it already represents over 6200 miles of railway. Not only are new lines being projected, but passing places are being added to the old lines which, as nearly everywhere in Africa, are single lines. Stations of wood are being rebuilt of stone or brick, carriages and engines are being increased, and more powerful locomotives and heavier rails are being introduced in order to meet a traffic which is increasing every day.

South Africa is now entering upon the era of its greatest economic progress. Gold and diamonds are not its sole riches. There is also copper to be extracted, and coal is found in abundance in Natal

(already 350,000 tons are raised there annually), in the Orange River Colony, and in the Zambesi district. The Karroo, Natal, and the two old Republics, all very healthy countries, are admirably suited for cattle-breeding and agriculture. Before mining began the Boers were essentially a nation of agriculturists and cattle-rearers. On the slopes of the Drakensberg, in Natal, tropical plants, such as the sugar-cane and tea, grow beside those of Mediterranean or temperate regions. Districts devastated by the recent war are recovering; the Boers are rebuilding their farmhouses, and the cattle slaughtered are gradually being replaced. European settlers require every day larger supplies, and imports are constantly increasing. The imports to Natal alone, even admitting that a part goes into the interior of the Continent, have quadrupled in ten years, being valued at £13,861,000 in 1891 and £47,167,000 in 1902.

While about 1894 the South African market occupied only the sixth place for imports from Britain, it is to-day surpassed only by India, and the time may come when it will hold the first place. Such prosperity makes the cost of railway construction a matter of small importance, especially as railways are essential. The richness of South Africa and its economic development are guarantees that the future will pay for railway construction, however high the cost. Owing to the structural difficulties of the country, and the lack of labour, the costs are high, but the results cover the expenses and are sometimes very wonderful where a seaport benefits by railways. Cape Town has already 160,000 inhabitants, Durban has 60,000, and her commerce in 1902 exceeded 1,102,000 tons. In 1903 the trade receipts of the Cape railways amounted to £5,329,868, while their expenses were £3,898,321. During the same year the Natal railways received £2,561,551, against £1,791,108 of expenses. "The chief wealth of Natal," wrote M. Aubert, French Consul-General at Johannesburg, "consists in her railways."

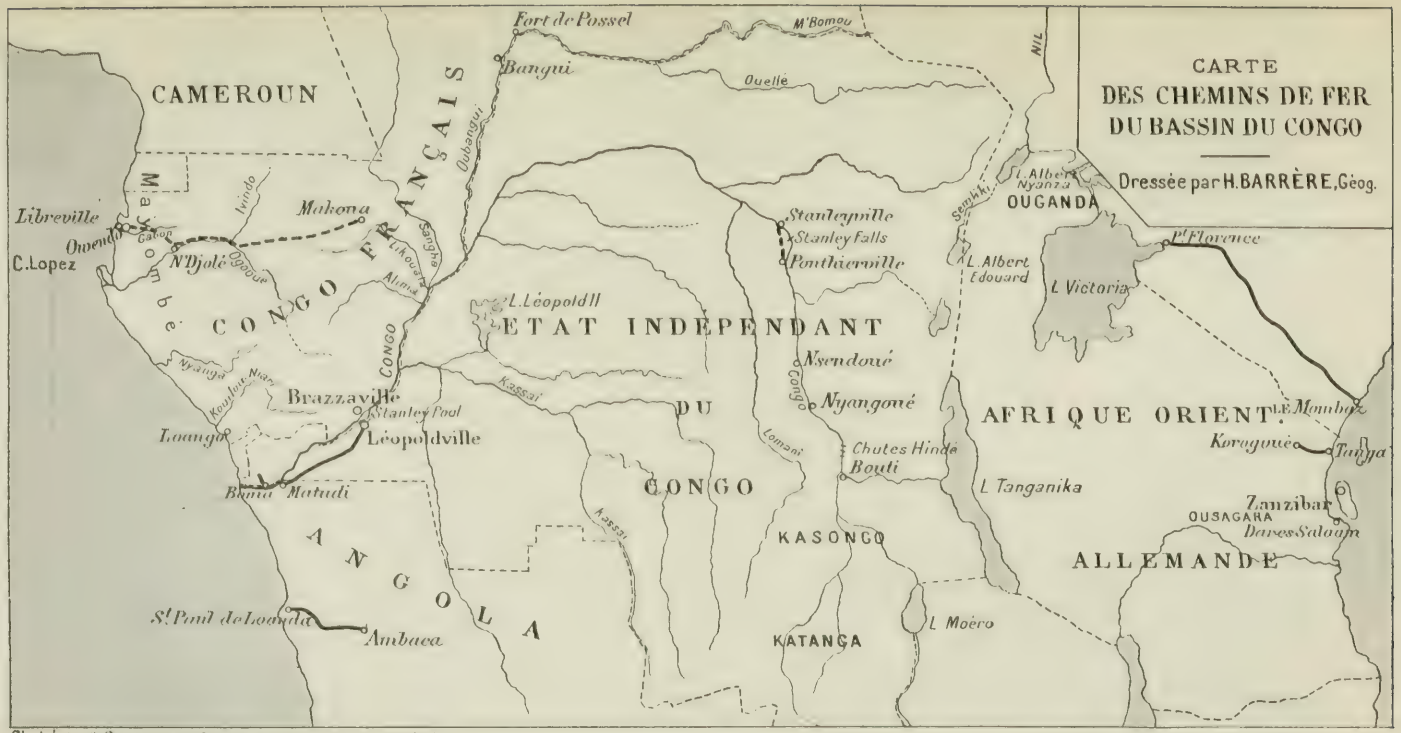
German South-West African Railways.

In 1892 the German Government resolved to make a railway in its South-West African possessions, and gave the concession to a British company, but, owing to the protests of the Fatherland, this contract was cancelled, and the work was executed by officials and employees of the Imperial German Railways. The railroad starts from the bad seaport of Swakopmund on Walfisch Bay, and after scaling the mountainous side of the interior plateau reaches the capital, Windhoek, a distance of about 237 miles. It took nearly five years and £1,000,000 to construct this narrow-gauge railway, while the navvies were decimated by disease, but the difficulties surmounted occasioned much pride and rejoicing when the railway was formally opened in July 1902. In spite of financial and other difficulties connected with this unremunerative colony, the German Government has resolved to spend large sums in improving the harbour of Swakopmund and even speaks of extending the railway line to Mafeking. Another narrow-gauge railway, 354 miles long, will connect

the mining district of Otavi with Swakopmund, and it is hoped that this line will be opened in 1907. A sum of £250,000 was voted last year as a first instalment of the cost of a railway from Lüderitz Bucht (Angra Pequena) to Kubub, and a second sum of £143,000 will be devoted to it this year. These latter railways will be constructed by means of black labour superintended by officials of the military staff of the Imperial Railways of Germany. There was at one time a project by the same British company which received the first German concession to run a railway right across Africa from Pretoria *via* Otavi to Port Alexander in Portuguese Angola, 1243 miles in length, which would have brought Pretoria 1243 miles nearer Europe, but German colonial feeling prevented the project taking shape, as it was thought that Rhodesia and the Transvaal would be benefited at the expense of German South-West Africa, and that the mineral wealth of Otavi would be exported from the Portuguese Port Alexander. So in 1902 it was decided to connect Otavi with the German port of Swakopmund.

Portuguese Angola Railways.

Only one railway, as yet, exists, that from the insufficient port of St. Paul de Loanda to Ambaca, centre of the coffee, tobacco, and earth-nut cultivation, which is 211 miles in length. It was constructed 1887-94, and it is proposed to extend it to Malangé and Kassangé, upwards of 124 miles further inland. A railway from Mossamedes to the Huilla sugar district is projected. A British company has been authorised to construct a line from the port of Lobito, about 19 miles north of Benguela, and which, passing that town, would proceed into the interior towards Rhodesia, where it would join the line to Beira. The Benguela railway was projected by Mr. Robert Williams, Managing Director of "Tanganyika Concessions, Limited," who at a meeting of this company held in London on 31st October 1906, stated that the railway would open up an immensely valuable mineral field around Katanga in the extreme south-eastern corner of the Congo Free State (and 100 miles north of Broken Hill station on the Rhodesian Railway), wherein were a hundred copper mines extending over 200 miles, a belt of tin-bearing reefs extending 150 miles, the Ruwe gold-mine and an iron-field. In the *World's Work* for October 1906 Mr. Ambrose Talbot gives an illustrated account of this railway, which, he says, will be some 950 miles long, will be completed in about two years, and will bring Pretoria 3000 miles nearer London. It will, he adds, extend in an almost direct line from Lobito Bay, which has exceptional anchoring facilities, to Katanga where it will link up with the Cape to Cairo railway. Mr. Talbot mentions that Cecil Rhodes explained that, although the Cape to Cairo line might possibly not be extensively used for traffic throughout the length of Africa, yet it would constitute a railway backbone from which, as the country was opened up, other lines would branch off in all directions. By such means it would act as the main trunk system connecting the various points with the two great centres north and south.



Cliché des "Questions Diplomatiques et Coloniales

FIG. 5.—The Railways of the Congo Basin.

Congo Free State Railways.

In 1890 a narrow-gauge railway was begun from Matadi near the mouth of the Congo, which after immense difficulties reached in 1898 Leopoldville on Stanley Pool. This railway was 241 miles in length, and although it cost more than £3,000,000, being certainly the most expensive African railway, its commercial success, owing to ivory and rubber exports, was assured. It was also most useful for the transport of officials, troops, and supplies, not merely into Belgian but also French Congo, and it furnished the means of access not only to the basin of the Congo but also to a portion of the Sudan. The gross receipts annually exceed £370,000.

Another line, nearly 50 miles long and completed in 1900, stretches from the port of Boma to the Mayombé district; but, though passing through a rich country, it is as yet only of local interest. There is a proposal, however, to extend it to the French frontier. In order to facilitate transport through the Congo Free State, a company was formed, with the assistance of King Leopold, to introduce railways into the districts of the Upper Congo and the Great Lakes. The land being given to it by the Congo Free State, this company proposes to construct the following lines:—1st, From Stanleyville to Ponthierville (74½ miles) in order to pass the Stanley Falls; 2nd, From Nsengué to Buli (about 124 miles) to pass the Hindé rapids; 3rd, From Stanleyville to Lake Albert (about 497 miles); and 4th, From Nyangué or Kasongo on the Congo to Tanganyika (about 124 miles). By the Lake Albert and the Nile Valley route a new outlet will be given to the Congo Free State, and by the Tanganyika route the State will reach the Rhodesian railways and compete with British enterprise in South Africa.

French Congo Railways.

These exist only in the prospective. Captain Cambier of the French Engineers surveyed last year a line from Libreville on the coast to Makua on the Likuala, a distance of over 520 miles, and in February last notice was given in the French Chamber that Government would be asked to guarantee a loan enabling this railway to be made. Neither structural nor labour difficulties are anticipated, but the cost will be considerable, about £5000 per kilometre (0·62 of a mile.) Still M. Jacob considers that the rubber, ivory, and other products of the rich French Congo territory will soon cover the cost of this railway. This concludes his papers on the Railways of Africa, which will amply repay perusal in the original French, for, to an abundance of statistics, implying immense knowledge and study, M. Jacob unites an enthusiasm and wealth of argument in favour of the penetration of Africa by railways, which leads one to believe that that will prove the surest way of imparting light to the Dark Continent. Ralph Richardson.

THE REPUBLIC OF COLOMBIA.[1]

TIME was when our ignorance concerning the various Governments in South America was only equalled by our general indifference to the affairs of that continent. It was looked upon as a region where revolutions occurred with the regularity of the seasons; where bonds were repudiated; and where, generally, to invest money was to throw it into the proverbial fire. But times have changed, and our ideas are changing with them; and, truth to tell, it is time they did. For, as in the far-off days of geologic time, the giant ranges of the Andes rose out of chaos, and, during successive periods of volcanic disturbance, reared their huge peaks toward heaven, so in later political times, there have emerged out of the seething cauldron of revolution state after state, each one tempered by fire, and gradually settling down into prosperity. Students of history, as well as members of the Stock Exchange, will have noted how Peru and Chile, Brazil and the Argentine, have steadily asserted their claims to be admitted into the comity of responsible nationalities; and now Colombia, with her great possibilities, calls for attention. Mr. Petrie's volume is welcome for many reasons. It is probably the only recent authoritative work on the subject in the English language, and although the author gives a very modest estimate of it, and disclaims all literary merit, the reader will form a very different opinion of it. Not only has Mr. Petrie travelled far in the country himself, but he has read all that is worth reading about it, and he gives us the benefit of his studies.

The Republic of Colombia, then, is interesting for many reasons; for its vast extent, representing over 400,000 square miles; for its relatively sparse population, suggesting outlets to other overpopulated countries; for its history, which, according to Mr. Petrie, has yet to be written; for its mineral and agricultural wealth, and for its trade generally. Other more venturesome nations are already well ahead of us in the race. Colombian bonds, which stood a few years ago at 14 or 15 per cent. in the London market, are now about 46, which shows that commercial confidence is rising.

The extent of the country may be best understood if we consider that its area roughly corresponds to that of Spain, Portugal, France, Holland, and Belgium together. It is bounded on the north by the Caribbean Sea, on the west by the Pacific, on the east by Venezuela and Brazil, and on the south by Ecuador and Peru. Colombia is still fighting with these various states about her boundaries. The great mountain ranges of the west coast are aptly compared to the skeleton of a left arm. The upper arm lies away to the south; the fore arm divides into its two lines in Peru and Bolivia; the irregular bones of the wrist are represented by the group of giants in the Ecuador; while in Colombia the mountains spread out into the three main ranges of the

[1] *The Republic of Colombia.* By F. Loraine Petrie. London: Edward Stanford, 1906. *Price* 8*s.* 6*d.*

western, central, and eastern Cordilleras, the little finger and thumb being represented by supplementary offshoots. To the east the country spreads out in extensive plains, clothed with forest and pasture land, and drained by the Orinoco and the Amazon, or rather by their tributaries. The western Cordillera is the barrier towards the Pacific. None of the great peaks are to be found in it, none exceeding 11,150 feet. The lowest pass is 6725 feet, and it has only been cut at one point in the south by the river Patia, which, after traversing a gorge where the mountains rise sheer to 10,000 feet, reaches the Pacific. There are thus so far only two means of tapping the country from this coast, one passage through the gorge, and one over the pass, leading to Buenaventura. This range is richest in minerals. The central range is the highest, Huila rising to 18,000 feet, Tolima to 18,400, and there are many other peaks. The snow line is 15,000 feet, the limit of forest growth 10,000, and between these limits exist the *Paramo* or cold desert, a region bleak beyond description, almost without vegetation, always covered by a cold, dense fog, and in many places swampy. These paramos occupy all the summits of the western range, and all the passes of the central, so that they constitute an important hindrance to communications. The eastern Cordilleras are lower than either of the others, and are mostly heavily wooded.

It will be understood that there are but few passes of communication across the central range. The two most noted are that known as Quindio, running between Ibague and Cartago; and another which communicates between Puerto Berrio and Medellin, which latter is the one which it is thought will be chosen when the question of improved railway transit comes to be discussed.

The chief rivers of Colombia are the Cauca, running from south to north between the western and central Cordilleras, and joining the other river, the Magdalena, before entering the Caribbean Sea. The Magdalena, the more important of the two, flows between the central and eastern ranges, and forms the main means of communication between the coast and Bogotá, the capital of the country.

Naturally, in a country with so many divergent physical aspects, the climate shows great variations, from the tropical and unhealthy climate of the lowlands in the region of the Caribbean Sea, to the heights round Bogotá, where, at 9000 feet above the sea, there reigns an eternal spring. There are three classes of people permanently occupying Colombia. First the Indians, who were there when the conquerers arrived, a gentle, rather indolent and patient people, for whom Mr. Petrie has a great regard. Then the negroes, imported at one time to supply the needs of labour, an unpleasant people devoid of all the virtues, but unfortunately possessing an undiminished power of reproduction. Lastly, the Spaniards, pure and mixed. With all these different races, there is no feeling of caste, so far as colour goes, the Indian and negro are as good as the Spaniard. This is the work of the Church.

The history of Colombia ought to afford tempting material for the student. How many of us know who "El Dorado" was? The "Gilded Man" was the anointed heir of the Chibcha kingdom, where Bogotá is

now, and the story of early Spanish conquest is largely the quest for El Dorado. In 1533 Heredia settled himself on the coast, and instituted expeditions which were said to have netted for him and his men no less than £14,200. But Quesada was the real discoverer of the kingdom of Chibcha. The history of this terrible journey is very grim. He started with a thousand men and arrived in a year's time with a worn and wasted 170. But they had found El Dorado, and soon troops of adventurers swarmed in from all sides, and then began the cruelties associated with the Spanish lust for gold, and the subsequent horrors of the Inquisition. From that time, Colombia has been the scene of almost incessant warfare: the three centuries which intervened between Quesada and Bolivar were marked by the enslavement of the Indians, the attacks of Drake and others. The history of Bolivar is still waiting for its exponent, how he consolidated the Republic which then comprised Colombia, Panama, Venezuela, and Ecuador; how he died a comparatively poor man, and how, after his death, the various states broke off. Latterly again in 1903, came the final breaking away of Panama, perhaps the shrewdest blow of all to the prosperity of Colombia. All this and much more is fully dealt with in the text.

But to come down to the present time, we have to deal with Colombia's means of communication with the outer world, and it will not be out of place to glance at the situation of Bogotá, the capital. It may be wondered why a site so inconveniently far from the coast should have been selected for the seat of the central government, but probably several conditions combined to influence the choice. For one thing, it was the capital of the ancient kingdom, and again, its climate is the most suitable for the white man. Even at the present time it seems to have taken the author about three weeks to arrive there from the coast, and one does not gather that his was an unusually protracted voyage. Bogotá lies at 9000 feet above sea-level, in a wide valley surrounded by a fringe of mountains. Quesada was a native of Granada, and Bogotá reminded him so much of his birthplace that he named it New Granada. The plain seemed to him like another Vega; the town creeping up the hill must have resembled the Alhambra, if indeed there were buildings there at that time; the snowy peaks of the central Cordilleras were there to remind him of the Sierra Nevada, and altogether there was a certain resemblance in the eyes of the Grandino.

The climate is an ideal one. The mean temperature is about 59° Fahrenheit in the shade throughout the year, and the nights are cool. Tropical diseases, such as malaria, yellow fever, and the like, are unknown; and tuberculosis has no abiding habitation among the natives. Wonderful stories are circulated regarding restoration to health of the most advanced cases, and indeed the miracle would seem to be that these advanced consumptives ever reached Bogotá in anything but a state of collapse, so unpleasant is the present mode of transit. Looking round from an elevation, it is difficult, says the author, to believe that one is not near the sea-level, and it is only when the barometer indicates 22 in place of 30, and the pulse and respiration show a certain amount of disturbance that one realises that the town is nearly twice the altitude

of Zermatt, and that the monastery of Guadalupe, 2300 feet above, where one goes for a view, is well above the level of the Théodule Pass. The air is so clear that from this point, even the waving of a handkerchief in the streets of the city below can be seen. Bogotá should be a most valuable health resort for the tuberculous were communications improved.

In considering, then, how Bogotá may traffic with the outside world, it is to be remembered that Colombia has two seaboards, one towards the Pacific, and one facing the north and looking into the Caribbean Sea. The Pacific coastline is walled out, as it were, by the great Western Cordillera. There is practically only one sea port, Buenaventura, and only one pass from Cali to this port by which the trade of the rich upper Cauca valley may be tapped. This outlet, therefore, is of small importance owing to its distance from Europe, and would continue so indefinitely, were it not for the prospect of the Panama Canal. Mr.

The Pier of Savanilla.

Petrie feels sure, not only that the Canal will be completed within a measurable distance of time, but that it will be a sea-level undertaking without the hindrance of locks. This will bring the East Coast infinitely nearer New York and the European markets, and will make it much more easy to exploit the great mineral wealth which undoubtedly exists all along the valley of the Cauca. Meantime, the chief ports are on the Caribbean Sea. The Magdalena is the great river which drains the country from south to north, and, with the exception of a small reach full of rapids, is navigable all the way to Girardot, the nearest port to Bogotá. The other affluent, the Cauca, joins the Magdalena near its mouth, so that nearly the whole of the region occupied by the Cordilleras and their valleys drains into the Caribbean Sea by one river mouth, and this is rendered unapproachable from the sea by a bar. The starting-point above this bar is Barranquilla, and the problem has always been how best to connect it with the ocean traffic. Round to the west of the river mouth is Savanilla, situated in a shallow bay. It has been made practicable for the entry and discharge of large steamers

by the erection of a pier 4000 ft. long, which has sufficient depth to accommodate several large steamers at a time. There is this objection that during a northerly gale it is often necessary to order the shipping to sea, as there is the danger of their carrying away the entire wharf: moreover there always exists the possibility of the silting up of the harbour. Meantime, it is the most important landing-place for cargo. It is connected with Barranquilla by a railway 18 miles long. Further round to the west lies the ancient harbour and city of Cartagena. There are two narrow channels, within which is found a large and capacious roadstead. The principal entrance, the Boca Grande, was negotiated so often by hostile powers, beginning with Drake, that the inhabitants filled it up so that only small craft can now pass. The Boca Chica, the other entrance, is not so convenient. From Cartagena to the river there is a canal which was commenced by Philip II., but is now largely silted up. There is also a line of railway 65 miles in length to Calamar, 66 miles up the Magdalena from Barranquilla. The harbour of Cartagena is undoubtedly superior to the open roadstead of Savanilla, and projects are in the air to clear the Boca Grande, and to render the canal once again possible for traffic. There are also other ports in the Caribbean Sea, but these are of minor importance.

There is no regular railway system in Colombia. Isolated lines there are in various parts, as, for instance, from Barranquilla to Savanilla, and round Bogotá; also on the Magdalena there is a short line from La Dorada to Honda to carry the traffic past the rapids. None of these, however, are linked up, nor have they any correspondence with one another. There are several projected schemes, and some in the course of construction. It is projected, and here the reader may consult the map, to connect the line from Girardot on the Magdalena, to Bogotá; also to carry the line down from Girardot to Honda, where the rapids commence. Again, it is suggested that the route to Buenaventura on the Pacific should be facilitated by completing the line from Puerto Berrio to Medellin. There would thus be established more or less direct communication with the Cauca valley, and so to the route from Cali to Buenaventura. One advantage of this route would be that the line would tap the richest mineral districts. All these schemes are in the air, *mañana* as the Spaniard says, and Mr. Petrie's warning is that they should proceed slowly and with great caution, so as not to load the country with further burdens.

The inland carrying trade is largely done by stern wheel steamers, which are not models of any of the virtues. The roads are very bad, much worse than the authorised descriptions would lead one to believe. Altogether, it will be obvious that the means of communication are very primitive.

The mineral resources of the country are after all its chief wealth. It was gold which attracted the Spaniards in olden times, and it has been gold which has tempted adventurers ever since. The wealth of this metal has been enormous. Much that Pizarro extracted from the inhabitants of Peru came, it is suspected, from the slopes of the Cordilleras. The interesting legend of the instalment of El Dorado, the

heir apparent to the kingdom of the Chibchas is told: how, having been smeared with gold dust, he was floated out on the lake on a raft, and how gold and jewels were piled beside him and were thrown into the water as a propitiation. The gold-bearing regions are almost confined to the valley of the Cauca and the Western Cordillera. It has been calculated that from the sixteenth century to 1886, the amount of gold extracted was £127,000,000, and that the larger proportion came from the provinces of Antioquia and Cauca. Again, another very rich region is at Chocó and Barbacoas on the Pacific slopes. Reports say that in spite of the quantities taken away, there is no sign of exhaustion of the supply. Mr. Petrie gives valuable hints and words of caution to the intending prospector. The Colombian emeralds are the finest in the world. Much information is given about the working of the mines.

Silver is also found, but at the present rate of exchange, it is not very lucrative. Copper, coal, salt, and many other minerals are being worked by the inhabitants.

An account of the general financial condition of Colombia and its prospects would be incomplete without some allusion to the present President, General Reyes. First an explorer, no one living knows more of the less frequented parts of the Republic than he does. When quite young, he, with two brothers, undertook an expedition to explore the tributaries of the upper Amazon. One of the brothers died of fever, the other was eaten by cannibals, and he returned alone. Since then, Reyes has been soldier and politician. Colombia itself had been decimated and impoverished by wars for the last hundred years, until its exchequer was well-nigh empty, and labour was not to be had. The country was flooded with paper money, the "peso" or dollar was worth a halfpenny. Then came the secession of Panama in 1903, an irreparable misfortune. The United States, wishing to have the control of the Scheme for the making of the Canal, offered to Colombia £2,000.000, to be followed ten years later by an annual payment of £50,000, which besides the value of the 50,000 shares held by Colombia in the French company, would have gone far to have rehabilitated the national finance. The Colombian Government would have none of it, the outcome being that Panama seceded, and all the purchase money has gone to this little state, and Colombia gets nothing. The whole matter is in the hands of the diplomatists, and it is to be hoped that the Republic will save something out of the wreck.

At this stage, in 1903, General Reyes was made President, and has so controlled the destinies of the country that, as we indicated earlier, the price on Colombian bonds has risen from 15 per cent. to 46 per cent. He found his country very much in the condition in which Porfirio Diaz found Mexico in 1876: he has profited by his experience, and seems to be following his example. There is no reason why he should not be equally successful, if he lives long enough and has peace in his borders. He is an older man by eighteen years than was Diaz when he began the work of regeneration of Mexico, but he may not encounter so many obstacles. General Reyes is evidently a notable man, and we may wish him God-speed.

We must not conclude this notice without drawing the reader's attention to the degree in which Germany is absorbing the trade of Colombia. The line of steamers from New York is German, the Hamburg-America Company's Atlas Line, many of the river boats are also in German hands, and they have captured a large slice of the commerce. This is being carried out by means which are quite legitimate. As Mr. Petrie points out, "the British trader seems to go on the principle that it is business to tell the Colombian what he wants, whereas the German, more wisely, finds out what his customer desires, and supplies him with it."

The illustrations are perhaps not on a level with the text, but the photograph of the Roadstead of Savanilla, showing the pier extending out to sea like a fishing-rod, is very instructive. One would not like to be tied to the end of it during a gale. By the courtesy of the publishers we are able to reproduce this illustration.

"THE VOYAGE OF THE *SCOTIA*": A REVIEW.[1]

THIS work, *The Voyage of the "Scotia,"* is assured beforehand of a cordial welcome from our readers. The expedition, of which it is the record, has been the subject of profound and widespread interest for several years, and ever since the project of a special Scottish expedition to the Antarctic regions was proposed, our readers have had exceptional opportunities of watching its progress, vicissitudes, and success. In September 1902 the head of the expedition, Mr. W. S. Bruce, read a paper to the Geographical Section of the British Association at Belfast, in which he defined the scope of the expedition and announced to the public the names of those whom he had selected as his companions. Three expeditions were already in the field—the German, headed by Dr. Erich von Drygalski; the Swedish, commanded by Dr. Otto E. Nordenskjöld; and the English, under Captain Scott. To these three Scotland was to add a fourth, the special object of which was "to specialise in oceanography and meteorology, and its sphere was to be the South Atlantic Ocean between the tracks of the Swedish and German expeditions." Mr. Bruce's paper was published in our issue for October 1902, and in the following month the *Scotia*, amid the enthusiastic acclamations of friends and well-wishers, started down the Clyde on a voyage of 7000 miles. Being favoured with good weather it reached Madeira in less than three weeks, and then, in the words of the leader of the expedition, "the departure from Madeira marked the commencement of scientific work." The *Scotia* dropped anchor in Port Stanley, in the Falkland Islands, on the 6th January 1903, having taken only fifty-nine days to sail from Kingston, in Ireland, to Port Stanley.

A halt of something like three weeks was necessary at Port Stanley in which to make the final preparations for the voyage into the Weddell

[1] *The Voyage of the "Scotia."* By Three of the Staff. Edinburgh: Blackwood and Sons, 1906.

Sea. The general idea was, after leaving Port Stanley, to steer south-east until a longitude of 30° West was reached, and after that to proceed due south as far as was practicable. From first to last Mr. Bruce was averse to the *Scotia* being imprisoned in the ice. Writing from Port Stanley on the 24th January 1903 he said, with regard to his plans for the coming season, "Should we be successful in finding a comfortable harbour, the *Scotia* will winter there, and will return to the Falklands as soon as she is released in the spring of 1903-4." With this letter from Mr. Bruce, there came the interesting notes by other members of the expedition on physical observations of the sea, botany, zoology, geology, and meteorology, which appeared in this *Magazine* in April 1903. The letter and

Shags Nesting (from *The Voyage of the "Scotia"*).

notes made our readers acquainted with the progress and work of the expedition up to its departure from the Falkland Islands on the 26th January 1903. The first Antarctic cruise of the *Scotia* lasted from the date of its departure from Port Stanley to the 25th March, when it lay up for the winter in what is now known as Scotia Bay at Laurie Island in the South Orkneys, and during these two months it sailed over 5364 miles of sea, the greater part of which had not been previously explored. On the 29th January it encountered its first heavy gale, and next day sighted its first iceberg. On the 2nd February it sighted the pack ice, and the real Antarctic work was commenced when it had forced its way through the pack into a more open sea. On the 4th February the expedition landed at Saddle Island, in the South Orkney group, which had been visited by Weddell in January 1823. An attempt was made to

proceed south-east round Cape Dundas, but this proved a failure owing to the thickness of the ice. After this, when the party got free from the ice, they worked eastward along the 60th parallel till the 15th, when they found themselves in comparatively clear water, which offered special facilities for the important work of taking soundings. The temperature, however, began to fall, and on the night of the 21st February the *Scotia* was imprisoned for some hours in 70° 25′ S., 17° 12′ W. Next day, on getting free, they made their farthest south sounding in 2543 fathoms. This done, the expedition made for the South Orkneys, recrossing the Antarctic Circle on the 11th March, having, as Mr. Bruce pointed out "sounded ten times in depths varying from 2425 to 2651 fathoms, having taken temperatures and salinities of the water at various depths from the surface to the bottom, and having lowered the trawl four times." The *Scotia* dropped anchor in Scotia Bay on the 25th March, and by the 30th the pack ice had closed it in for the season, *i.e.* till the 23rd November. "This fact," writes Mr. Bruce, "is perhaps one of the most remarkable in the history of Polar Exploration; that in an oceanic island in so low a latitude as 60° to 61° S., it was possible to be ice-bound for so long a period. I even venture to doubt whether there is any record, during all the long years of North Polar exploration, of a ship being frozen in for eight months in latitude 60° or 61° N., even when surrounded by all the winter rigours of a continent. It is probably due to a practically continuous ice-sheet forming between the South Orkneys and Graham's Land to the south-west, the islands for the time being lying, as it were, on the edge of a continent."

No time was lost in commencing the hard work of building a house and observatories and observation cairn; and so conscientiously and carefully was the work done that it is believed the house and cairn "will last for centuries to come, and form a base for any future scientific expedition exploring in the neighbouring waters, and a refuge to any shipwrecked crew who may be stranded on these inhospitable shores." When the work of building had been completed, the regular routine work of the winter was carried on without interruption. On the 6th August there occurred the one sad fatality of the expedition, viz. the death from heart-disease of Mr. Ramsay, the engineer. When spring arrived, four journeys were organised, the scientific results of which were summed up by Mr. Bruce as "a 25-inch survey of Scotia Bay, including an area of nearly 25 square miles, and a 2-inch survey of Laurie Island and the adjacent island, including an area of about 150 square miles; 472 soundings are included in the survey in depths up to 84 fathoms. A running survey has also been made of the east and north coasts of Coronation Island."

Leaving Mr. Mossman and his party at the meteorological and magnetic station in Laurie Island, the *Scotia* on the 27th November departed for the Falkland Islands and Buenos Aires, where after a comparatively uneventful voyage they arrived in time for Christmas. Mr. Bruce had gone ahead in the *Orissa* from Port Stanley with a view to making all the necessary arrangements and economising time. He was most successful in interesting the Argentine Government in the scientific part of the work, and it was arranged that the Argentine Government would

defray the cost of the upkeep of the scientific station for a year, and the *Scotia* would carry the men and the stores there. The men in question were a naturalist and two assistant meteorologists, who were to remain at Laurie Island with Mr. Mossman when his Scottish assistants returned to their duties on the *Scotia*. A whole month was required at Buenos Aires for dry-docking and thoroughly overhauling the *Scotia*, and in coaling and provisioning for the coming season. The return voyage from Buenos Aires to Scotia Bay was concluded on the 14th February. In the course of a week the coals and stores for the scientific station had been safely landed and housed, and the *Scotia* was ready to set out on its second campaign in the Weddell Sea.

Ringed Penguins (from *The Voyage of the "Scotia"*).

The story of this second campaign has been told by Dr. Pirie and Mr. Rudmose Brown in the pages of the January number of this *Magazine* for 1905. The *Scotia* seems to have encountered very bad weather, and was more than once in danger of being imprisoned in the pack ice, so it was decided to turn north-eastwards and examine what was known in the charts as the Ross Deep. The result of the *Scotia's* examination was to remove the Ross Deep from the chart, as within a mile of the place where Ross had reported a sounding of 4000 fathoms and no bottom, the *Scotia* found bottom with a sounding of only 2660 fathoms. Having made this important contribution to our knowledge of the Antarctic seas, the *Scotia* turned to the north and made for Gough Island, where it arrived on the 22nd April. Our readers will find an excellent account of this little-known island in a chapter of this book

from the capable pen of Mr. Rudmose Brown. The principal scientific results of the *Scotia's* second voyage have been summed up by Dr. Pirie thus:—"In the Weddell Sea a large number of soundings, and the finding of a southern limit at Coats Land, show this sea to be considerably less extensive in area and depth than was previously supposed. Numerous observations on the temperature and salinity of the water have been taken at all depths, samples of the bottom deposits got, and a zoological collection gathered which embraces a large number of birds in addition to seals, fish, and representatives of almost every class of the invertebrates, from the surface water, from intermediate depths, and, above all, from the bottom of the ocean. Systematic plankton collections were also made. At the South Orkneys materials were collected for a detailed map of Laurie Island; a continuous hourly meteorological record was kept for eleven months, a record which is still being kept, and which is supplemented by similar observations taken by the *Scotia* all the time she was at sea; magnetic observations were made, which this year will see still further extended under Argentine auspices; the botany and geology was investigated, and an extremely rich shallow-water fauna collected, in addition to numerous specimens of the seals and of the birds of the locality, with their eggs. In the South Atlantic a somewhat deeper channel has been demonstrated between the Falkland Islands and the South Orkneys than was previously supposed to exist. Further to the east, the ocean's contours have been materially changed by the discovery of a large southern extension of the Mid-Atlantic ridge to the south of Gough Island. Physical and biological work has been carried out in a hitherto entirely uninvestigated ocean; and on Gough Island a small but representative collection of the fauna, flora, and geology has been made for the first time." The *Scotia* reached Table Bay, at the Cape of Good Hope, on the 5th May 1904, and after a fortnight's stay there it started on its voyage home, arriving at Millport on the Clyde on the 31st July, where, as our readers already know, the members of the expedition received the enthusiastic welcome they had so richly deserved.

The story of the voyage has, of course, been practically rewritten and greatly expanded in the volume now before us, but the distinguished head of the expedition contributes only a few words of preface by way of introducing the three members of his staff who have compiled the work between them, viz. Mr. Mossman, Dr. Pirie, and Mr. Rudmose Brown. In addition to the story of the *Scotia*, we have also a "brief summary" of previous Antarctic exploration, with regard to which there will be but one opinion, viz. that it is much too brief. Even assuming that our readers are familiar with the subject, they will be glad to have the whole history of the expedition in the compass of one volume. It is true, as the authors themselves point out, that they have no startling adventures or exciting incidents to relate. The story, as told us, is the sober record of solid, earnest, patient, scientific labour under strange and trying conditions. To the reader who wants a popular account of the expedition, and at the same time an indication of its scientific results, we gladly recommend this interesting volume, which, we may add, is

illustrated with many beautiful photographs, two of which by the courtesy of the publishers we are able to reproduce here, and is equipped with excellent maps. Necessarily some time must elapse before the scientific members of the expedition can make public in a complete form the results of their arduous labours in Antarctica, but from what has already been published we can be assured that the contributions to the science of Antarctic Geography, which are the result of the expedition of the *Scotia*, are second in importance to none of the contributions of their distinguished predecessors and contemporaries.

A STUDY OF A SWISS VALLEY.

ALL visitors to Switzerland who take any interest at all in their surroundings have doubtless been struck by some of the features of the life of the peasants; for example, the disproportion between the apparent number of inhabitants and the number of habitations, the constant migrations of both the cows and their keepers, the laborious care with which little patches of grass are harvested as hay, and so on. If many doubtless regard peasants, cows, and châlets as merely a picturesque part of the environment, others are interested in those toilsome lives, which in the more isolated regions are still so little influenced by "Messieurs les étrangers," and all the paraphernalia of illuminated waterfalls, mountain railways, and so forth got up for their special benefit. The more scholarly of the guide-books have always devoted some space to the life of the natives, and such a book as the new edition of Ball's *General Introduction to the Alpine Guide*, for example, contains a full and, geographically, a most interesting account of life in an Alpine valley throughout the year. This account is, however, largely based on Northern Switzerland, and our readers may be interested in a recent paper which gives a detailed picture of life in a southern valley—the Val d'Anniviers. In the July issue of the *Annales de Géographie*, MM. Jean Brunhes and Paul Girardin publish a paper entitled "Les Groupes d'Habitations du Val d'Anniviers comme types d'établissements humains," of which we propose to give a brief account here.

This particular valley is known to mountaineers as the means of access to the mountain resort of Zinal, and is geographically of interest in that it is typical of a whole series of valleys lying to the south of the great trough of the Rhone, most of which have a characteristic Y-shape, the stalk of the Y pointing, roughly speaking, to the north, while the limbs represent the two tributary valleys which stretch southward. It not infrequently happens that each limb of the Y contains a mountain resort—the mountaineer will remember Saas and Zermatt, Arolla and Ferpècle as examples. In the case of the Val d'Anniviers, the eastern branch contains Zinal, while the western branch has no settlement save that of Grimenz near its origin. For long but little known, the valley, as regards its human inhabitants, shows some interesting features, now largely lost or modified in the adjacent valleys. The nomadic life led by the natives of Swiss valleys in general, here reaches its most marked development.

The main physical features are easily detailed. The valley—like the lateral valleys in general in this region—originally entered the depression of the Rhone by a hanging valley, in which the stream—the Navigenze—has now excavated a deep gorge. The consequence is that the lower part of the valley is unsuitable for human habitation, as here it is impossible to approach the stream, which runs at the bottom of precipitous rock-walls. Visitors will remember that the new road in places tunnels through the rock, as occurs also in certain of the adjacent valleys, thus emphasising the difficulty of access of the upper part of the valley. In the vicinity of the gorge there are stretches of the road without any sign of human habitation whatever—no houses, no fields, no trace of cultivation. Above the gorge, where the valley widens out, lies the region of habitations, which extends up to the point where the valley bifurcates, and forms the true centre of the valley. Visitors to Arolla will remember the almost exactly similar conditions which exist there, Evolena and Haudères, for example, being placed on what is, roughly speaking, a plain, separated by steep gradients alike from the Mayens of Arolla and the hot, swampy flats of the Rhone with its towns and vineyards. The life of the people is in intimate dependence upon these geographical conditions, and in its simplest form might be described as a periodical migration up and down from the high pastures according to the needs of the flocks. But in the Val d'Anniviers the migrations are of a much more complicated nature than such a summary would indicate. Each family has no less than four types of dwelling, in geographically distinct localities, and the year is distributed among all four—so that there is no "permanent habitation." As the authors point out this is pastoral nomadism modified by the special conditions. The climate is such as to render tent life impossible, and the construction of temporary huts equally impossible. The consequence is that the Anniviards have solved the problem by the construction of no less than four types of dwelling. As we shall see, while for the most part their migrations are determined by the needs of the flocks, one, that downwards to the plain of the Rhone, is the result of the attraction exercised by the vineyards of the plain. The result of the migrations is that the natives are self-supporting, producing virtually all that they need. Their wealth, like that of primitive people in general, is in their flocks and herds, and not in precious metals. For money they have but little use, and as there is thus no need for trade they have preserved their primitive characteristics for a prolonged period. The curious indifference to the tourist displayed in the more unsophisticated parts of these valleys is thus readily explained, for the stranger has nothing to offer that they prize.

To return, however, to Professors Brunhes and Girardin's paper. They consider in detail each type of settlement, beginning with the villages of the valley, which are not here, as in some other parts of the Alps, winter villages, for only a part of the winter is spent in them. The village is the largest collection of houses and peoples in a district, and centres round the schoolmaster. It is distinct from the two older types of government, the political grouping or commune, and the ecclesi-

astical grouping or parish, neither of which is necessarily coextensive with the village. Thus the inhabitants of the village of Grimenz are not all members of the commune of Grimenz. From afar the village may be recognised by its church. It is geographically determined as to site by its function as a resting-place on the road to the high pastures, the position halfway between the rocky barrier below and the bifurcation of the valley above being the most convenient, and here the villages tend to congregate, the constituent dwellings being arranged in a long, straggling row near the road. The unit in each village is not a cottage but a miniature homestead, consisting of at least three buildings, and in consequence the village appears very much larger than the population justifies. Each family requires first a dwelling-house, then a byre with a hayloft above, and finally one or two granaries or storehouses. As wood is cheap, it still forms the chief building material in spite of the very real danger of fire, though there is now obvious a tendency to replace it by stone. As each house, so far as possible, is arranged to obtain the maximum of sun the houses do not necessarily face the road, and as there are usually no windows on the shady side, the village has a characteristically uncoordinated appearance, which is perhaps a reflection of the unspecialised social life. The type of structure is always the same, a basement of stone supporting two stories of wood with galleries running round. The windows are small and are placed in groups. The want of permanency of the habitations doubtless accounts for the apparent want of care in construction, for the houses have rarely that decoration which renders those of Northern Switzerland so picturesque. Beside the house is the cowshed with its loft, as already indicated, and there is usually a granary for unthreshed grain, as well as a storehouse, where are kept bread, cheese, wine, and dried meat for the winter. The cellar beneath stores the famous "vin du glacier." The granary proper is raised on piles, with a flat, projecting stone on top of each pile to keep out rats. Within is the threshing floor, where the grain is threshed during the winter leisure. Round the building runs a wooden gallery, where various fodder plants may be seen drying.

The second type of habitation is designated by that characteristic word—*mayen*, so familiar to the tourist in the valleys. Mayen is the equivalent of the German *Vorsäss* or *Voralp*, and is in brief the pasturage of spring and autumn, the region intermediate between the village and the alp, where the flocks linger for a period both on the upward and downward journey. As the name indicates, in essence the mayens are the pasturages used in the month of May, the high alps not being, as a rule, clear of snow till well on in June. In the Val d'Anniviers the village zone, according to our authors, extends between 1200-1500 metres, while the zone of mayens extends from 1500-2000. In the general case the mayen can be distinguished from the village by the absence of the church, and if, as at the mayens of Zinal, a church is present, the causation is to be looked for in the altered conditions produced by the incursion of tourists. Further distinctions from the village are found in the absence of fields and of granaries, and in the predominance of the cowhouse, which is the essential structure of the

mayen. To this essential the house is subsidiary, and it may be merely an annex. It is perhaps hardly necessary to point out that most of the tourists' resorts of the valleys are superimposed upon a mayen and not upon a village, hence that absence of prosperous dwellings which strikes the tourist so much at Arolla, for example. The geographical cause of the mayen, whether in its primary meaning of pasture, or its subsidiary meaning of dwelling on the pasture, is to be sought in the climatic conditions of the Valais, which result in an early growth of grass. As the lateral valleys run, roughly speaking, north and south, the position of the pasturages is not determined by the direction which they face, but by the amount of exposure to the sun, as may be seen by the way in which the mayens occur first on one and then on the other side of the stream as the exposure permits.

The second station above the village is the alp; the exploitation of which in the language of the authors of the paper is the raison d'être of the villages of the valley, and the chief resource of the inhabitants. Owing to the climate of the Valais, pasturage is possible at a higher level than in the Oberland, for example. The forests extend up to about 2000 metres, so that the lower limit of the alps is 1800-2000 metres, and from this point they extend up to about 2700 metres, giving a range of 700 metres. As to ownership, the alps for the most part belong neither to individuals nor to communes, but to groups of proprietors, forming associations. They feed a large number of cattle, the census of 1901 giving the number as 2100, which approximately is equal to the number of human inhabitants. The constructions found on the alps are primitive, the essential one being the cheese-making hut. Generally the anterior part serves as the house of the cheese-maker, while the cheese and milk are kept in the posterior part. As wood is wanting on the alp, the hut is built of stone. Beside it is a shelter for the cattle, usually consisting of a simple enclosure of dry stone, often roofed with planks. Only the cowherds go up to the alp, and in the Valais these are always men, who are elected every year, and number eight for each alp. In addition to the charge of the cattle, they of course make the cheese, which is divided at the end of the season.

The fourth type of habitation is that of the villages found in the valley of the Rhone. These settlements owe their origin to the irresistible attraction which the vineyards exercise upon the mountain folk. Since 1243 there are records of Anniviards possessing vineyards in the valley, and as they take their herds with them in their downwards migrations fields must be added to the vineyards. In consequence around Sierre there is a series of villages which like the settlements of the Val d'Anniviers are empty for much of the year. Three times a year the valley population troops downward, leaving only a few members of the community as watchers in the uplands. The principal sojourn is in March in order to prune the vines and for the cattle to consume the winter herbage. In autumn after the vintage is gathered the must is conveyed to the cellars in the mountains, where it is converted into the celebrated "vin du glacier." The villages of the valley

have their counterparts in the villages of the plain, so that the group unit is preserved throughout the migration. For the most part the villages of the plain resemble in construction those belonging to the permanent inhabitants.

In spite, however, of the periodical visits to the plain the mountaineers have preserved their pristine simplicity of life. In the summer the women work at the same tasks as the men, in the winter they weave and spin, and plait straw for hats, while the men construct their own houses, make the furniture, make their own shoes and so forth. Wealth consists in abundance of cattle, and does not involve any difference of life or of dress in its owners. The diet of all is exceedingly frugal, and the life is spent in almost continuous toil which allows no time for the search of amusement, say our authors; but the psychologist might say that in so varied a life there is no need for amusement, as there is in the monotonous lives of more specialised peoples. The mode of government is also exceedingly primitive, the affairs of the community being decided at the Sunday meetings, when all assemble at the close of Mass. There is virtually no emigration, and the population is increasing, so that a complete utilisation of the natural resources is essential, and the whole life of the community may be summed up as being a search for the sun. Wherever the effects of ancient glacial action are visible in the widening of the main valley, or in the hollowing out of lateral valleys, advantage is taken of the fact, and the position of villages, of individual houses, of fields, of gardens, of pastures, is always determined by the maximum possible exposure to the all-powerful sun. In detail the authors show how the varying elevations to which cultivation ascends is always determined by exposure.

Next to sunshine, the great essential for growth is water, and therefore like the vineyards, like the fields and the mayens, the alps are irrigated, the watercourses or "bisses" being most skilfully arranged. Each is controlled by a guardian, who is elected by all those participating in the benefits of the water.

In conclusion it may be well for the sake of clearness to sum up the annual migrations of the Anniviards. In March, so soon as the vines are clear of snow, they descend to the Rhone valley, where they work in the vineyards through Lent, ascending to the villages of the valley in Easter week. Here the crops are planted in the fields, and when this task is completed, the cattle, with their owners, ascend to the mayens to consume the herbage. From the mayens the cows with their selected guardians ascend step by step to the high alps, while the other members of the community make a second descent to the plain of the Rhone, and in August and September re-ascend to the villages to gather in the crops. By the time the cows descend to the villages at the end of September the crops are garnered, and all are ready to descend once again to the plains for the vintage. At the end of November the cattle ascend to go into winter quarters at the mayens, and from these in March they descend with their owners *via* the villages to announce to the inhabitants of the plain the coming of spring. Any scheme of this kind has of

course the disadvantage that it makes the migration a more formal matter than it really is, for the dates are not absolutely fixed, but depend to a large extent on the variations of the crops, the weather, etc. But it is to be carefully noticed that the migration is not a mere seasonal one in the ordinary sense, for the Anniviards mount higher in January than in November, but is determined by the conditions already indicated, and is infinitely more complicated than the ordinary nomadism of the Alpine valleys. It is a modification of pastoral nomadism produced by the geographical conditions.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

A Meeting of Council was held on the 8th November, when the undermentioned ladies and gentlemen were elected Members of the Society:—

Miss M'Vitie.
Henry Claude Osborne, F.E.I.S., F.R. Hist. Soc.
James Cruickshank.
David S. Bucher.
John M'Farlane, M.A.
Mrs. Gordon.
William Booth, F.R.C.S.E.
Miss Mary H. Bell.
John Marshall, LL.D.
Adam Cairns.
Rev. J. E. Wallace.
Edward M'Cash.
A. Knox Brown, M.Inst. M.E.
Miss I. J. Aitken.
R. Maitland Cowan, Writer.
Mrs. Agnes Campbell.
Mrs. Inglis Clark.
Henry James Peddie.
William J. Hardie.
Mrs. Lamont Campbell.
Alexander Brand, J.P.
Hugh Marshall, D.Sc. (Edin.), F.R.S., F.R.S.E.
James Lindsay.
Rev. J. H. Oldham, M.A.
James Ruthven Douglas.

Lectures in December.

Major A. St. Hill Gibbons, F.R.G.S., on the 10th of December will deliver in Dundee a Lecture entitled the "Transition of British Africa." He will repeat his lecture in Edinburgh, Glasgow, and Aberdeen on the 12th, 13th, and 14th December.

Professor D'Arcy W. Thompson, C.B., M.A., will deliver the annual Christmas Lecture in Dundee on the 18th December. His Address will be entitled "The North Sea."

On the 21st December in Edinburgh, the 22nd December in Glasgow, and the 24th December in Aberdeen, Professor J. Arthur Thomson, M.A., will deliver the Christmas Lecture. His Lecture will be entitled "From Pole to Pole—Characteristic Animals of Various Latitudes." The Christmas Lectures will be delivered in the afternoon.

Diploma of Fellowship

The Council conferred the Ordinary Diploma of Fellowship on Henry Claude Osborne, F.E.I.S., F.R. Hist. Soc., Head-Master of the Military

Hill School, Dover, a member of the Society, who had complied with the prescribed conditions.

The Annual Business Meeting.

The Annual Business Meeting was held on the 8th November in the Society's Hall, National Portrait Gallery, Professor James Geikie, D.C.L., LL.D., F.R.S., President of the Society, in the Chair.

The Chairman, in moving the adoption of the Report, said that in every respect it was exceedingly satisfactory. He would like to refer to a movement commenced by members of the Society for the establishment of a Chair of Geography in the University of Edinburgh. They had already secured about £2000, and although this sum would only go a small way towards the establishment of a Chair, they could only hope that members would bring the subject more forcibly before those who were willing and able to contribute. Another point was a proposal by the Council to introduce a new set of Associates, namely, teachers, and a resolution laying down the terms and conditions under which "Teacher Associates" would be allowed to join the Society would be laid before the meeting.

The Twenty-second Annual Report of the Council was then read by the Secretary, which stated that during the year 186 new members had been added, and that the membership had increased from 1790 to 1852. On that day the Council had elected twenty-five new Ordinary Members. Thirty-four ordinary meetings were held during the session—eight in Edinburgh, eight in Glasgow, nine in Dundee, and nine in Aberdeen.

The Vice-Presidents were re-elected. The Right Hon. Lord Sempill was elected a Vice-President in place of the Right Hon. the Earl of Mansfield, whose death the Society has to deplore.

The following members of Council who retired by rotation were re-elected:—Dr. John Horne, John Clarke, M.A., H. B. Finlay, Wm. B. Wilson, W.S., Dr. John Gunn, Lieut.-Col. F. Bailey, Kenneth Sanderson, W.S., Sir James A. Russell, LL.D., H. M. Cadell, B.Sc., Dr. Robert Fullerton, and Alexander Mackay, C.A.

The following members of the Society were elected to fill vacancies on the Council:—Harry W. Smith, W.S., F.R.S.G.S., David Christison, M.D., LL.D., V.-P. Society of Antiquaries of Scotland, George Smith, M.A., George Mackenzie Brown, Charles E. Price, M.P., Hon. John Abercromby, W. G. Burn-Murdoch, Ebenezer Duncan, M.D., and A. E. Maylard, B.Sc.

Dr. Paul Rottenburg, I. Julius Weinberg, J.P., F.R.G.S., and Professor J. Arthur Thomson, M.A., were re-elected Chairmen of the Glasgow, Dundee, and Aberdeen Centres respectively.

Teacher Associates.

The President then proposed the following Resolution:—"That with the object of helping to promote the teaching of Geography in schools, 'Teacher Associates' be admitted to certain privileges of the Society at a reduced subscription of half-a-guinea, the privileges to be limited to

the use of the Society's Rooms, receipt of the monthly *Magazine*, the right to borrow *one volume* from the Library, and *one* ticket (not transferable and admitting only one) for the Society's Meetings. Only professional teachers will be eligible for election, and applicants must state name of school at which they are engaged. Teacher Associates will not be eligible for the Society's Diploma of Fellowship or for election to the Council." This resolution was unanimously adopted.

Mr. W. S. Bruce, F.R.S.E., proposed that in future earlier notice of the Annual Business Meeting be given to members, and that the names of those suggested by the Council to fill existing vacancies be circulated to each member. The President pointed out that these proposals had already been discussed, but promised that the Council would give them further consideration.

The Annual Report was then put to the meeting by the Chairman, and Mr. Currie having submitted the Financial Report, both were unanimously adopted.

The Secretary read the programme of Lectures, and the meeting terminated.

GEOGRAPHICAL NOTES.

Polar.

Peary's Arctic Expedition.—News arrived in New York on November 4th to the effect that the *Roosevelt*, with Commander Peary on board, arrived at Battle Harbour, Labrador, on the previous day. Although Commander Peary has not succeeded in reaching the Pole, he has reached 87° 6′ N. lat., or in other words has approached to within about 200 miles of the Pole. The previous records were that of Captain Cagni, of the Duke of the Abruzzi's expedition (86° 33′), and that of Dr. Nansen (86° 14′) in 1900 and 1895 respectively. Peary has thus surpassed Nansen's record by 60 miles, and Captain Cagni's by about 30 miles. The telegram sent by Commander Peary to New York was as follows :—

The *Roosevelt* wintered on the north coast of Grant Land, somewhat north of the *Alert's* winter quarters. We went north with sledges in February *via* Hecla and Columbia. We were delayed by open water between 84° and 85°. Beyond 85° a six days' gale disrupted the ice, destroyed the caches, cut off communication with the supporting bodies, and drifted us due east.

We reached 87° 6′ North latitude over ice, drifting steadily eastward.

Returning, we ate eight dogs. We drifted eastward. Delayed by open water, we reached the north coast of Greenland in straitened conditions. We killed our musk oxen and returned along the Greenland coast to our ship.

The two supporting parties were driven on the north coast of Greenland. One was rescued by me in a starving condition.

After one week's recuperation in the *Roosevelt*, we sledged west, completing the north coast of Grant Land and reaching other land near the 100th meridian.

The homeward voyage was an incessant battle with ice, storms, and headwinds. The *Roosevelt* is a magnificent ice-fighter and sea-boat.

No deaths or illness occurred in the expedition.

The course of the expedition can be followed on the map published here (vol. xix.) to illustrate Peary's last journey. The interesting points geographically, so far as the brief telegram indicates them, are, first, the facts that open water was found in the neighbourhood of the highest latitude reached, and that the ice was drifting steadily to the east, not to the north-west or west as Nansen found it to the north of Behring Strait; and second, the discovery of new land to the north of the islands discovered by Sverdrup in his expedition. It would appear that the archipelago mapped by that explorer must be continued far to the north, and perhaps also to the west. The map referred to above, which shows Peary's routes of 1900 and 1902, shows also how far he has surpassed his own previous record of 84° 17′ in 1902. We offer Commander Peary our hearty congratulations on his great achievement.

The Monaco Spitsbergen Expedition.—H.S.H. the Prince of Monaco returned to Havre in September with the scientific yacht *Princesse Alice*. During the last summer he has had several parties on board who have thoroughly explored the northern part of Prince Charles Foreland and the north-western part of the mainland of Spitsbergen between Liefde Bay, Smeerenburg Sound, and Cross Bay. The party on Prince Charles Foreland was a Scottish one under the leadership of Mr. Wm. S. Bruce, of the *Scotia*; that under the direction of Captain Bourez, of the French Navy, made a hydrographical survey of Cross Bay; and two Norwegian parties, under the leadership of Captain G. Isaachsen and Lieutenant Staxerud, surveyed the north-western part of the mainland. High-level meteorological observations were conducted by Professor Hergesell of Bonn.

Dr. Jules Richard was as usual in charge of the scientific work on board, while the Prince superintended and arranged the work of the different parties. Altogether probably a larger, more valuable, and more extensive series of surveys and obeservations have been made during this summer cruise of the *Princesse Alice* than have been made by any other Spitsbergen Expedition in a similar period.

Scottish National Antarctic Expedition.—Another of the floats thrown overboard during the voyage of the *Scotia* has been recovered. This float was thrown into the sea in lat. 44° 11′ N., long. 16° 5′ W., on July 11, 1904, and was picked up on West Caicos Island, one of the most south-easterly outliers of the Bahama group, in lat. 21° 37′ 30″ N., long. 72° 28′ 15″ W., on October 13, 1906. It has thus taken two and a quarter years to cross the Atlantic, travelling no doubt at first southward by the Canary Islands Current and afterwards westward by the North Equatorial Current.

Commercial Geography

The Foreign Trade of Burma.—In 1905-6 the foreign oversea trade of Burma was somewhat less than in the two preceding years, but the imports of merchandise reached a total of £5,450,500, while exports

of Indian produce amounted to £10,334,500. No less than 88 per cent. of the trade of the province is concentrated in the rapidly developing port of Rangoon. As in the case with Indian trade generally, the principal business is done in a few commodities. Thus, of the imports into Burma, cotton goods constituted 29 per cent. of the total, while metals, provisions, and silk (including silk goods), make up 22 per cent., leaving 49 per cent. for all other articles. In exports this limitation is still more remarkable, for rice (including rice-bran) formed no less than 81 per cent. of the exports, while the next item in value, teak, formed only 4 per cent. The huge rice trade of Burma was, however, not quite up to the level of 1904-5, as, owing to a partial failure of crops in India, there was a larger demand for rice, and the consequent enhancement of price checked the European demand. Japan is normally the largest foreign purchaser of Indian rice, other large buyers being the Straits, Java, Germany, and the United Kingdom. It is a curious fact that the export duty on Burma rice, £546,700, exceeded the total receipts from import duties by £143,700. The relatively small trade of the minor Burma ports is chiefly in rice.

Perhaps more real interest attaches to some of the other branches of trade which loom less large in the returns. The rapid development of the Burma petroleum industry is especially noticeable. In 1905-6. Burma exported £58,700 of kerosene, £62,170 of paraffin wax, and £109,180 of paraffin wax candles to foreign countries, while 52,926,400 gallons of oil, valued at £1,976,000, were sent to India by coasting vessels. Installations for bulk oil have been established all over India, and a high grade of white water oil is now being produced to compete with American and Russian oils. Owing to the cessation of ruinous competition with foreign syndicates, the Burma oil industry is now in an excellent position, and may look forward to a practical monopoly of the Indian market. The export of paraffin-wax candles has steadily grown from £3900 only four years ago to £109,180, the candles being in demand for mining purposes all over the world. Burma sent abroad £190,000 of raw cotton, while the export of hides and skins has advanced by leaps and bounds, the growth in four years being 255 per cent., owing partly to the higher range of prices. Jadestone was exported to the extent of £51,000, and though the quantity was smaller than in 1904-5, the value was greater owing to the better quality. The teak trade would be much larger if supplies of timber were available, for the demand has been urgent.

Railway Development in Canada.—An interesting article in the *Times* discusses recent railway developments in Canada in their relation to the transport problem. The problem for Canada is to get the grain from her wheatfields to the ocean steamers between harvest time and the closing of the great waterways by frost—a period of about three months. The map shows that a great system of waterways, formed by the St. Lawrence Gulf and River and the chain of the great inland lakes. penetrates to the very heart of Canada. This system is navigable for ocean steamships as far as Montreal, which is situated on the St. Law-

rence shortly below its junction with the Ottawa River, *i.e.* a third of the way from the open sea to Winnipeg. From Montreal navigation is possible for smaller vessels by way of the upper waters of the St. Lawrence and around through the great lakes to the twin cities of Port Arthur and Fort William, situated in Canadian territory, at the head of Lake Superior, and some 345 miles by rail east of Winnipeg. From this point westward the railways have to be relied upon entirely. It may be said, however, that a scheme is on foot to complete a channel from Lake Superior north-west through Rainy River and the Lake of the Woods to Winnipeg River, and past the city of Winnipeg to Lake Winnipeg. The large lake of Winnipeg strikes northward for a distance exceeding that from Liverpool to London, and Hudson Bay bends down from the northern coast to meet it and receives the discharge of the Nelson River, whose upper waters almost reach Lake Winnipeg. Through this river, it is said, a canal will be driven. It is then the intention to have a line of steamers between Hudson Bay and Great Britain during certain seasons of the year. In the meantime, however, the railways are facing the problem of bringing out the wheat from the North-West, hauling it to Winnipeg, and past that city to the beginning of navigation at Port Arthur and Fort William.

Up to the present, as is well known, only one railway stretches across Canada, the Canadian Pacific Railway, the connecting link of which was completed in 1885, during the North-West Rebellion. Two other transcontinental lines are now being built, the Canadian Northern and the Grand Trunk Pacific. The former already has many lines in Canada, and has connected up the wheatfields with the head of navigation; the Grand Trunk Pacific has just commenced building.

This road, when completed, will run across Canada entirely within Canadian territory, and in this respect will be unique. The eastern and western divisions are practically each 1800 miles in length, making a total of 3600 miles from end to end, exclusive of branches, which will reach a length of about 1400 miles. The eastern division runs from Moncton, B.C., on the Atlantic, to Winnipeg, Man., the western running from Winnipeg to Prince Rupert, B.C., on the Pacific.

The portion of the line about which least is known is that from Edmonton to the Pacific coast. The first 100 miles from Edmonton has, however, been arranged. On the other end of the section the engineers are working eastward from the coast, along the Skeena river to Hazleton, a distance of about 180 miles inland. But no decision has yet been reached as to what pass shall be taken through the Rocky Mountains. Three passes are mentioned, the Peace River Pass to the north, the Yellowhead to the south, and the Pine River Pass, between. Until the fullest information has been collected by the engineering staff, now scattered through the mountains, and the question has been fully considered, there will be no decision upon this important matter. Prince Rupert, the Pacific Coast terminal, is north-west of Edmonton and is situated on Kaien Island. As yet it consists of but a few huts, but ere many years it will be a splendid city. Kaien Island is only divided from the mainland by a narrow strip of water, easily bridged. Here

has been designed a fine harbour for the accommodation of the large fleet of steamships which will ply these northern waters as soon as the railway has been completed. Engineers are now at work arranging for the various terminal facilities which will shortly be required for the new Pacific port. The Government is also making an exhaustive exploration of the harbour with a view to finding and removing all obstacles to navigation.

Another railway project which has come to the fore recently is a somewhat ambitious one. Briefly stated, the project is to carry a Canadian railway through to Newfoundland by way of a tunnel under the Straits of Belle Isle, thereby largely decreasing the time taken for the conveyance of mails and passengers between England and any point of the North American seaboard. The Quebec and Lake St. John Railway is to form the connecting link from Quebec through Labrador to the proposed tunnel, and it has already obtained important privileges from the Government of Newfoundland, including charters for the construction of a railway from the Canadian and Newfoundland boundary of Labrador at Blanc Sablon to the Straits of Belle Isle, and for constructing the tunnel under the Straits. The Quebec and Lake St. John Railway already has a charter for the construction of a railway through the Labrador Peninsula to the eastern boundary of the province of Quebec, and it is proposed to use this charter in the carrying out of the proposed project. The proposed route of the railway is along the tableland which forms the watershed whence numerous large streams flow southwards into the Gulf of St. Lawrence, and the country is described as rich in forest wealth. The point selected for the Belle Isle Tunnel is just opposite Point Armour, where the Straits are not more than ten miles wide, and the depth of the water is under 150 feet. From the Newfoundland end of the proposed tunnel it would only require the construction of 30 miles of railway to connect with Hare Bay on the north-east coast of the island. This harbour is said to be almost always clear of fogs, and it is distant about 1800 miles from the west coast of Ireland. By building a short distance further south, connection could be made over the Reid system of railways with the port of St. John, giving a longer railway but considerably shorter ocean journey.

EDUCATIONAL.

THE September number of the *Journal of Geography* contains an article on "What a child should know at the end of its School Course," which deserves the attention of teachers. The author, Mr. W. C. Moore, points out that the prudent teacher must be prepared for the fact that the child will forget almost all the details which he has learned, and that therefore the aim of the whole geographical course should be to make sure that the unforgettable residue will be something of real value to the citizen—a habit of mind, a comprehension of the geographical mode of looking at phenomena. Stress is laid upon the need of supplementing text-book teaching by reference to current events, to the contents of the

newspapers, the magazines, the consular reports, and so on, in so far as they relate to geography. This not only makes the facts of geography real and living, but it establishes a habit of consulting atlas and book of reference in connection with periodical literature which is of permanent value. The need referred to seems to us real and clamant, and the daily increasing pile of geographical text-books and readers on the editorial table seems to us to further suggest the question whether the production of geographical school books is not in danger of being carried to excess. In the dark days when "scientific" geography was in its infancy, boys and girls were at least often encouraged to read for themselves the great books of travel, to follow, for instance, Livingstone's track across the unknown wastes; but now apparently they are supposed to be satisfied with an extract in a "Geographical Reader," while the *Travels* are left to grow dusty on the shelf. There is, of course, much to be said for the geographical reader, just as there is much to be said for the deluge of text-books, but surely there lurks in both a real danger also. We do not want the youthful mind to be fed entirely on the intellectual equivalent of "digested breakfast food." Nowadays almost every town of any size has its public library with both reference and lending departments. Would it not be better if, in place of swallowing the most irreproachable of text-books, the senior pupils at least were taught how to use the resources of a library, and how to deal with first-hand material, with blue-books, reports, and all that wealth of material which pours in upon any library? Further, rather than reading the most admirably arranged collection of scraps from famous books of travel, are they not better employed in reading for themselves the original books and being trained to give an account in their own words of the salient points. Let any public man speak on reading and libraries and we find him mourning the want of serious reading among the general public, the preference for the snippet type of literature; but may not this habit be first founded in the school, in the excessive use of the Reader in the later stages, and in the slavish adherence to text-books instead of allowing the pupil to get at least a glimpse of a wider world?

But if of the multiplying of little books on geography there is no end, there is one feature of many of the newer examples for which we have nothing but unqualified praise. We refer to the increasing use of illustrations, and the employment of colour-printing. We have been specially struck with the quality of the illustrations in M'Dougall's Geographies, especially in the *Concentric Series*, which consists of pamphlets costing threepence and fourpence each. In spite of the very moderate price the pictures in these booklets are well-chosen, often most artistic, and full of directly human interest, and there are in addition numerous maps and reliefs. The illustrations are not mere reproductions of familiar prints, but show that definite selection has been exercised. The days of pictureless, mapless, question-and-answer geographies, are not yet so far behind that it is not necessary to emphasise the fact that the battle is half won when the child realises that geography is about people, and the animals and plants surrounding them, and is concerned with the problem how in every climate man adjusts himself to the natural conditions, or strives

to adjust the conditions to his own needs. To take one example, a child whose attention has been rationally drawn to the pictures of Samoyedes in their tent, Japanese girls weaving silk, Chinese in a tea plantation, a Camel Caravan, and the other pictures contained in the booklet on Asia, has received a better idea of the geography of the region than if he had learnt pages of imports and exports, with all the human aspect omitted.

In the same firm's series of *Geographical Readers*, at a slightly greater price, we have added to the black and white pictures, maps and reliefs, some capital specimens of colour printing, which are bound to appeal strongly to the child. In the volume on England and Wales we have been especially struck with the fact that the unnamed compiler has been bold enough to realise—what we most of us still strenuously deny with our lips—that the centre of interest has long since shifted from the country to the town. The ships in the docks, the men and women in the workshops and factories, the busy streets of great towns—these are the real centres of interest for child and adult alike, though few are willing to admit the fact, and all these are depicted here.

Another set of Readers—*The New Century Geography Readers* of Messrs. Blackie, as exemplified in Book VII. (The World)—is especially remarkable for the beauty of the coloured illustrations, some of which are very fine indeed. The coloured illustrations in Jack's *Round the World Series*, various numbers of which have been already reviewed here, strike us as sometimes crude, but in other cases are quite successful, and the later numbers of the series show great improvement as contrasted with the earlier.

Attention may be drawn here to the interesting series of blank maps published by the Oxford Geographical Institute under the title of *Autograph Hand-Maps*. The maps are printed in dull brown, and have hill-shading inserted, and are exceedingly striking. In many cases, though not, we notice, in all, the projection used is indicated—an important point—and there is a scale of kilometres as well as of miles. The maps are specially intended to be used in mapping distributions, etc., and in capable hands might form the bases of some very interesting lessons. The cheapness of these maps is remarkable, and they may be cordially recommended to teachers.

In 1903 we published here a note (vol. xix. p. 604) on the new arrangement whereby the Ordnance Survey maps became available for teachers at a moderate price for teaching purposes. It is interesting to note that advantage is being taken of these maps—though to what extent the *Report* of the Ordnance Survey does not say—for we have received specimen copies of maps made up for two educational establishments in Scotland, the one on the six-inch and the other on the one-inch scale. The importance of such maps of the home district in helping a child to appreciate practically the symbols employed in mapping can hardly be overestimated.

We have received from Messrs. Sisson and Parker a full set of their

Kindergarten Geography and *Geography of the Eye* series of maps, together with map-books and a copy of Mr. S. T. Lodge's *Coloured Handbook to Kindergarten Geography*. The maps are lightly printed, and are intended to be coloured by the children and to have the names and outline traced over. The object of having the names already printed is, we presume, to ensure the neatness so dear to the inspector, but we rather doubt if it will be found easy to get the children to trace them over neatly, and from an educational standpoint we should have preferred blank maps on which the names might be placed as the lesson proceeded. A similar desire to make the maps easy to trace over accounts, we presume, for the very "hairy caterpillar" type of hachure which has in some cases been adopted for the mountains, and which is likely to give rise to very erroneous impressions. We greatly prefer to have the mountains represented by a line only as in some of the other maps. But there is much in the maps and method that is distinctly useful, and the *Handbook* contains suggestions for lessons which should prove highly valuable in the hands of a capable teacher. We recommend the series to the notice of teachers.

In *Science* for October 5 there is a lengthy and on the whole a highly laudatory account of the Royal Scottish Museum. The account is largely limited to the natural history and geological collections, and the high praise given by the author to most of the exhibits may be useful in serving to recall to teachers of geography in Edinburgh the wealth of interesting material contained in the Museum. The friends of the late Mr. Goodchild will be interested to perceive that the author of the article is of opinion that the climax of excellence is reached in the hall devoted to Scottish geology.

NOTE.—It has not been thought necessary to repeat here details as to the price, etc., of the books or maps alluded to. Full details will be found in the list of *Books Received* published every month, and in the list of *New Maps* published every second month.

NEW BOOKS.

EUROPE.

The Place-Names of Argyll. By H. CAMERON GILLIES, M.D. With a Preface from the DUKE OF ARGYLL. London: David Nutt.

Students of Scottish place-names may well congratulate themselves when they receive another volume like that of Dr. Gillies. He has tackled a huge piece of work with great pains, great skill, and no small success. He is an enthusiastic Gael himself, has generally secured the true native pronunciation, and his interpretations are, as a rule, sane, sober, reliable. One might have been inclined to say little more, had not Dr. Gillies positively challenged criticism by the statement on his first page, astounding to all who know anything of the subject, "I believe it [this book] is as nearly correct as any one could make it." First editions of such books must always largely be tentative, and it is a great pity that the

splendid work of our leading Gaelic scholars in this department should be so often marred by dogmatism and vanity. Dr. Gillies is fond of "without doubt," it generally prefaces a very doubtful statement; and no scholar should allow himself to write such a sentence as that just quoted. The truth is, there is large room for improvement, and we hope that the studious public will soon give the author the joy of a second edition, that these improvements may be made.

The omissions do not seem numerous; it would have been miraculous if there had not been some—*e.g.*, we can find no trace of interesting names like Toward, Pass of Brander, Castle Stalker, Ledaig, or Dhu Hearteach, nor of places with the dignity of a post-office like Achosnish (Ardnamurchan) or Dervaig (Tobermory). Moreover, Dr. Gillies has again and again forgotten to add the note he promises—*e.g.*, Conchra, p. 48; Loch Iall, p. 81, and, a specially provoking case, the dual name Awe, p. 58; nor ought he to have allowed the one letter K to do duty for the symbol of two districts, Knapdale and Kintyre. The well-known seaside resort beside Dunoon is given in the index as "Kerran (Kirn), p. 18, 194." On neither page is the place mentioned, though evidently Dr. Gillies would derive the name from Gaelic *ceathramh*, the well-known land-measure. Of this we believe there is no proof. It is almost certain the name is recent and English. The whole index is extremely tantalising, not to say deficient—*e.g.*, the only reference to Dunolly Castle is under the Norse name *Olaf*, from which Dr. Gillies does *not* derive Dunolly! The author really should have been a little more considerate of the average student. He ought not to forget that extremely few even of Gaelic speakers know how to spell that tongue, and that the average man is not likely to recognise Connel Ferry under Dr. Gillies's only form A' Choingheal, "the whirlpool." Every visitor to Dunoon has heard of Glen Masson, but almost none, even of the natives, know Coir' a' mheasain, which alone Dr. Gillies gives. A-barcle, "river of Torquil," is the correct native pronunciation of the little hamlet on the Shiel; but the only spelling known to the Post Office, Ordnance Survey, and the average man is Acharacle, for which the reader will search in vain.

Then it is certainly culpable that Dr. Gillies almost entirely ignores the labours of his predecessors. From his book one would suppose that nothing of value had been written on Argyll names except by Rev. J. G. Macneill on Islay, and by "Fionn." These are both excellent scholars; but it is not right that we should find only one mention that we have noticed of Professor Mackinnon, and no reference at all to his pioneering articles in the *Scotsman* of 1887, nor any reference to the first-class work of Messrs. Macbain and Watson in the neighbouring counties of Inverness and Ross, work which Dr. Gillies might often have consulted to advantage when the names were similar to his own. Not that Dr. Gillies would always be found wrong, *e.g.*, he has evidently never heard of Mr. Watson's much-enforced and hypothetical Pictish derivation of Carron "rough river," which suits neither the Argyll nor the Stirling place, whereas Dr. Gillies's derivation *car-abhuinn*, "twisting river," does. There is good reason for thinking that final *-an* or *-on* occasionally stands for *abhuinn* or *obhuinn*, "river"; but if our author had consulted Messrs. Macbain and Watson, he would have been much more chary than he is of postulating such an origin—*e.g.*, we cannot believe that the unstressed *-an* in Inverchaolan, Loch Striven, stands for "river"; it is the "Inver opposite the little strait," *i.e.* the Kyles of Bute. Had Dr. Gillies made proper consultation he could not have derived Saddell from "sand dale," seeing that the regular and frequent old form is Saga- or Saghadul; nor would he have imagined "Fionn" was the first to suggest that Inellan must mean "bird-island" (the Perch).

As we have said, our author's Gaelic interpretations are usually sane and

reliable; but sometimes one cannot agree—*e.g.*, Arna-hien or -hean, p. 50, is said to be *aird na h'aibhne*, "height of the river." There is nothing worth calling "a river" at Carrick Castle; *aibhne* never becomes -ien, but rather -aven, as in Portnahaven or Bunaven; and the native derivation *aird na nigheain*, "height of the maiden," is phonetically much to be preferred. To assert that Glendaruel must be *Gleana na ruaidh-eil*, especially when the -da- is already found in 1238, is to defy all phonetics; the same is true when it is said that Oronsay "without doubt is *orfiris-ey*."

With all his Keltic enthusiasm Dr. Gillies has not always, it would seem, tried to get the native name. He tells us, *e.g.*, that the name Loch Striven or Straven is not Gaelic, which is true enough; the Gaelic name is now hard to get, but a Gael now dead told the writer that it was Srainn, "Finn's Strath," which is confirmed by the oldest spelling, unknown to Dr. Gillies, 1595, Skriuen. Then, as to the well-known Gantocks at Dunoon, he tells us that "Gamhn(t)-aich is a favourite name for stirk-shaped rocks. There is no clear reason against this rendering here." As a matter of fact the fishermen here do call the rocks Na Gamhneachan, and the name occurs again on Loch Broom. But neither there nor at Dunoon do we know of any trace in Gaelic of the *t* which Dr. Gillies slips in; and the problem is, how did a name which, phonetically, Gaels pronounce Gównyachan ever became Gantocks? The only reference to hoary Dunstaffnage (p. xxii.) is disappointingly meagre and inadequate. Dr. Gillies says nothing of the Gaelic pronunciation. Indeed it is one case among scores when the Gael's pronunciation—so much vaunted at Inverness—is extremely uncertain and unreliable, because the name is not pure Gaelic. The termination -age, Dr. Gillies is sure means *ness*; he is no less sure about names like Craignish and Skipness; but in all three cases very old forms show that the native himself must often have thought it was *innis*, island or meadow.

Dr. Gillies's views about the Norsemen on our West Coast are peculiar and dubious. Where is the "abundant evidence" that the Norsemen had much to do with our Western Isles long before 800 A.D.? How does he know, for instance, that it must have been Norsemen who burnt St. Donan? (p. 177). On p. 90 he himself admits that, if the Norsemen gave its name to Coll, it was not so named in Adamnan's time, *i.e.* the seventh century. But we do think that the Norsemen had a hand in more names than Dr. Gillies thinks. We ourselves have a poor opinion of the stability of Gaelic pronunciations—*e.g.*, there is Auliston Point, which Gaels now call Rudha nan amhlaistean, which looks Gaelic enough. But no word the least like it is found even in the biggest Gaelic dictionary. Dr. Gillies says he is "quite familiar" with the word as meaning "tricks." The natives of Tobermory right opposite do not seem thus familiar, and tentatively explain the word as meaning "difficulties" or "troubles." It seems very likely that the Gaels imagined that this unfamiliar word was a genitive plural, and so stuck on the article; but really the name may be Norse for "Olaf's stone" or "rock." Similarly, Dr. Gillies says that Loch Indaal in Islay "= Loch an dàla," loch of the division; but the Gaels now call it simply Loch Andàl. There is fair evidence for the common spelling Indal or Andail, and that suggests an original Norse *önd-* or *and-dal*, "duck valley," from the old Norse *önd*, *andar*, a duck. Martin Martin in 1763 calls it simply Loch Dale.

At the same time we are glad to note that Dr. Gillies holds, what Mr. Watson vehemently disputes, that "the native rendering [*i.e.* interpretation] is always of value" (p. 169), with, of course, the proper caveats. We are equally interested to note that Dr. Gillies's book yields complete proof that genuine hybrids are numerous and not rare. We even have such names as Caddletown or "sleep

town" in Lorne, as well as interesting names like Dunstaffnage, or Drumlemble near Campbeltown, which Dr. Gillies dissects as G. *druim* and N. *lamba-fjall*, "lamb-hill"; though, by the way, the native Gaelic is *druim leamhan*, "hill-ridge of the elms."

Many other points tempt a reference, but we must now draw to a close this perhaps over-lengthy criticism of an extremely useful and valuable book. We think the appeal to Welsh to elucidate Loch Gilp is very dubious, and still think that loch is shaped very like the head of a chisel (G. *gilb*). And we should like to know, when Dr. Gillies says there are no abers in Argyll, if he denies the existence of a Kinnaber and a Badabery in Islay.

GENERAL.

Geology: Earth History. By Thomas C. Chamberlin and Rollin D. Salisbury. Vols. II. and III. London: John Murray, 1906.

The first volume of this work deals with geological processes and their results, and was noticed in this *Magazine* at the time of its publication two years ago. The present volumes discuss what is usually termed stratigraphical or historical geology, but the authors do not confine themselves to a bare summary of Earth History. On the contrary, the student is frequently introduced to the methods of interpreting the evidence, and to discussions of questions relating to the dynamics of geological science. For example, the deformation of the earth's crust, which is treated of at length in Vol. I., comes up for further treatment again and again in these later volumes, and the same is the case with the difficult question of geological climates. The authors tell us that "this recurrent treatment is intended to relieve, in some measure, the stress of treatment of these intricate themes at any one point, but more especially to combine dynamical discussion with the phenomena which it is to explain, as these phenomena unfold themselves stage by stage." There will be some difference of opinion as to whether this method is altogether satisfactory. For one thing, it leads to considerable repetition, and certainly interrupts the narrative of events, as these are recorded in the rocks. Their work, we think, would have gained in attractiveness had they confined themselves in the first place to a plain exposition of earth history so far as that has been more or less definitely ascertained—leaving for subsequent discussion the various complex problems which have long puzzled, and will probably continue to puzzle, geologists for generations to come. The authors very properly set forth the gradual evolution of the lands and seas, and endeavour to show how this has reacted on faunas and floras. They have much also to say that is at once novel and instructive about the features of the ancient lands—discussing the sources of the sediments of the various geological systems and the modes and conditions of their derivation. The historical geology of North America is necessarily treated of in most detail, and geologists on this side of the great water will be grateful for the very clear and luminous summary of the American evidence. While we are inclined to think that some of the elaborate discussions referred to above might well have been relegated to the close of the work, we should make an exception of the very suggestive introductory chapters which deal with the origin of the earth. Probably no section of the work will be read with greater interest by geologists. The nebular and meteoritic hypotheses of the earth's origin are passed in review and found wanting, while the planetesimal hypothesis of Mr. Chamberlin is set forth with much skill, and shown to be upon the whole more in accordance with the geological evidence. The whole subject of Earth History, as treated by our authors, cannot but give rise to much discussion. Their views on many points

will be disputed, but they give strong reasons for their conclusions, and one cannot but admire their freedom from prejudice, their candour, and the boldness with which they attack the most complex and intricate problems. Their work, in a word, is most suggestive, and a highly important addition to geological literature. The illustrations are numerous and excellent. Our only regret is that, in order to show off the process blocks to the best advantage, the book has been printed on glazed paper, the weight of which soon becomes to the reader a burden too grievous to be borne.

Les Tremblements de Terre—Géographie Seismologique. By F. de Montessus de Ballore. Paris: Librairie Armand Colin, 1906.

This important work contains a systematised discussion of the geographical distribution of earthquakes. The author has already published valuable memoirs on the subject of earthquake statistics, and in this work gives his matured views on seismological phenomena generally. With most of these all will agree. Some years ago M. de Ballore introduced a method of measuring seismicity, practically identical with the method of finding the average annual frequency of shocks per unit area. In the book now published he definitely gives up this method on the ground that earthquakes are discontinuous phenomena, so that all attempts to represent seismic distribution by means of continuous seismic lines or shaded areas rest on a false and unscientific basis. He has accordingly used a discontinuous method of indicating seismic frequency. A small black disk is set over each locality, the radius indicating on a purely conventional scale the average annual seismic frequency. The charts have a striking appearance, the eye being able to pick out at once the places of greatest seismicity. This method is, however, departed from in the cases of Italy, Japan, and the Philippines, the seismic frequencies of which are indicated by shaded regions. A graceful preface by the eminent geologist, M. de Lapparent, adds interest to one of the most important of recent seismological publications.

Some Facts about the Weather. By William Mariott. London: Edward Stanford, 1906. *Price 6d.*

This is a useful if somewhat scrappy little pamphlet, which begins with a quotation from Ruskin on Meteorology, and ends with an account of the Royal Meteorological Society. The maps and illustrations are for the most part useful and interesting, but we think the section on weather charts might with advantage have been fuller.

A Historical Geography of the British Colonies. By C. P. Lucas. Vol. I. The Mediterranean and Eastern Colonies. Second Edition. Revised and brought up to date by R. S. Stubbs, B.A. Oxford: Clarendon Press, 1906. *Price 5s.*

The first edition of this volume of the Historical Geography was reviewed here in vol. v. p. 109. As is only natural, considering the time which has elapsed, the new edition shows many changes. We miss the section on Heligoland, whose cession took place after the printing of the first edition, but we have a new chapter on British Somaliland, and the changes in the Malay Indies have necessitated a considerable amount of additional space in the sections dealing with them. There are also some new maps, which are not, on the whole, as successful as the older ones. That of British Somaliland, for instance, is rough and indistinct, and we notice that the author and the cartographer have not been able to agree as to the spelling of place-names, the former, for instance, using the French form of Jibuti.

The new edition will, however, be cordially welcomed by all those who have known and prized the first one.

NOTE.—By an oversight in the review of *Our Waterways: A History of Inland Navigation considered as a Branch of Water Conservancy*, which appears on p. 504, the authorship of the book was assigned only to Mr. Urquhart Forbes. The work is due to the joint labours of Mr. Forbes and Mr. W. H. R. Ashford.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Camp-Fires in the Canadian Rockies. By WILLIAM T. HORNADAY, Sc.D., Director of the New York Zoological Park. Illustrations by JOHN M. PHILLIPS, Pennsylvania State Game Commissioner. With 70 Illustrations and 2 Maps. Demy 8vo. Pp. xviii + 353. *Price* 16*s. net.* London : T. Werner Laurie, 1906.

India. By PIERRE LOTI. Translated from the French by GEORGE A. F. INMAN (of Bowdon). Edited by Robert Harborough Sherard. Demy 8vo. Pp. 283. *Price* 10*s.* 6*d. net.* London : T. Werner Laurie, 1906.

Swedish Life in Town and Country. By O. G. VON HEIDENSTAM. With 24 Illustrations. (Our Neighbours Series.) Crown 8vo. Pp. viii + 205. *Price* 8*s.* 6*d. net.* London : George Newnes, Limited, 1906.

Indian Life in Town and Country. By HERBERT CROMPTON. With 17 Illustrations. (Our Empire Series.) Crown 8vo. Pp. vii + 204. *Price* 8*s.* 6*d. net.* London : George Newnes, Limited, 1906.

M'Dougall's Geographies. Numerous Illustrations, Relief and other Maps. *England and Wales, British Isles, Europe, Asia, Africa, America, and Australia and Oceania.* 7 Parts. *Price, paper covers, 4d., cloth covers, 5d. each.* M'Dougall's Educational Co., Limited, 1906.

British Malaya: An Account of the Origin and Progress of British Influence in Malaya. By Sir FRANK SWETTENHAM, K.C.M.G., late Governor of the Straits Colony, and High Commissioner for the Federated Malay States. Royal 8vo. Pp. xii + 345. *Price* 16*s. net.* London : John Lane, 1906.

Canada To-Day. By J. A. HOBSON. Crown 8vo. Pp. xvi + 143. *Price* 3*s.* 6*d. net.* London : T. Fisher Unwin, 1906.

The Life of Isabella Bird (Mrs. Bishop). By ANNA M. STODDART. Demy 8vo. Pp. xii + 416. *Price* 18*s. net.* London : John Murray, 1906.

Portuguese East Africa: The History, Scenery and Great Game of Manica and Sofala. By R. C. F. MAUGHAM, H.B.M. Consul for the Districts of Mozambique and Zambesia. With Map and Illustrations. Demy 8vo. Pp. xii + 340. *Price* 15*s. net.* London : John Murray, 1906.

Folk-Tales from Tibet, with Illustrations by a Tibetan Artist, and some Verses from Tibetan Love-Songs. Collected and translated by Captain W. F. CONNOR, C.I.E., Secretary and Interpreter of the Mission to Lhasa, 1906. 4to. Pp. xii + 176. *Price* 6*s. net.* Hurst and Blackett, Limited.

Pagan Races of the Malay Peninsula. By WALTER WILLIAM SKEAT, M.A., and CHARLES OTTO BLAGDEN, M.A. With numerous Illustrations specially taken for the work. Demy 8vo. 2 vols. Vol. I. pp. xl + 724. Vol. II. pp. xii + 858. *Price* 42*s. net.* London : Macmillan and Co., 1906.

The Shores of the Adriatic: The Italian Side: An Architectural and Archæological Pilgrimage. By F. HAMILTON JACKSON, R.B.A. Royal 8vo. Pp. xiv + 358. *Price* 21*s. net.* London : John Murray, 1906.

Hints to Travellers: Scientific and General. Edited for the Council of the Royal Geographical Society by E. A. Reeves, F.R.A.S., F.R.G.S. Ninth Edition, revised and enlarged. 2 volumes. Crown 8vo. Vol. I. pp. xi + 470. Vol. II. pp. viii + 286. *Price* 15*s. net.* London: The Royal Geographical Society. 1906.

Trigonometry: Plane and Spherical, with the Investigation of some of the more important Formulæ of Practical Astronomy and Surveying. Specially arranged for the use of Students attending the Royal Geographical Society's Course of Instruction by E. A. Reeves, F.R.A.S., F.R.G.S. Demy 8vo. Pp. 87. London: The Royal Geographical Society, 1906.

A Cruise Across Europe: Notes on a Freshwater Voyage from Holland to the Black Sea. By Donald Maxwell. Illustrated. Demy 8vo. Pp. 255. *Price* 10*s.* 6*d. net.* London: John Lane, 1906.

Persia Past and Present. A Book of Travel and Research. By A. V. Williams Jackson. With over 200 Illustrations and a Map. Demy 8vo. Pp. xxxii + 471. *Price* 17*s. net.* New York, 1906.

Christian Rome. By J. W. and A. M. Cruickshank. Crown 8vo. Pp. 374. *Price* 3*s.* 6*d. net.* London: E. Grant Richards, 1906.

Scotland. Part II. Northern Highlands. By M. J. B. Baddeley, B.A. Thorough Guide Series. Seventh Edition. *Price* 3*s.* 6*d.* London: Dulau and Co., 1906.

The Guide to South Africa for the use of Tourists, Sportsmen, Invalids and Settlers. With Coloured Maps, Plans and Diagrams. Edited by A. Samler Brown and G. Gordon Brown. Fourteenth Edition. *Price* 2*s.* 6*d.* Sampson Low, Marston and Co., 1906.

Tamil Grammar Self-Taught. (In Tamil and Roman Characters.) By Don M. de Zilva Wickremasinghe. Crown 8vo. Pp. 120. *Price* 5*s.* London: Marlborough and Co., 1906.

Under the Sun: Impressions of Indian Cities, with a Chapter dealing with the later life of Nana Sahib. By Perceval Landon. Demy 8vo. Pp. xii + 288. *Price* 12*s.* 6*d. net.* London: Hurst and Blackett, Limited, 1906.

Wisa Handbook: A Short Introduction to the Wisa Dialect of North-East Rhodesia. By A. C. Madan, M.A. Crown 8vo. Pp. 136. *Price* 3*s. net.* Oxford: Clarendon Press, 1906.

Tibet the Mysterious. By Sir Thomas Holdich, K.C.M.G., K.C.I.E., C.B. With Maps, Diagrams and other Illustrations. Demy 8vo. Pp. xii + 356. *Price* 7*s.* 6*d. net.* London: Alston Rivers, Limited, 1906.

Also the following Reports, etc.:—

To Norway for Health: A Scientific Account of the Peculiar Advantages offered by the Norwegian Climate, with special reference to the Inland Winter Health Resorts. By A. Magelssen. With a Preface by Professor Yngvar Nielsen, Ph.D. Pp. 48. Kristiania, 1906.

Report on the Department of Lands, New Zealand, for the year 1905-1906. By William C. Kensington, Under-Secretary. 3 Parts. Wellington, 1906.

Meteorology in Mysore for 1905. Thirteenth Annual Report.

Report on Rainfall Registration in Mysore for 1905. By John Cook, M.A., F.R.S.E. Bangalore, 1906.

Administration Report of the Marine Survey of India for the Official Year 1905-1906. Bombay, 1906.

Annuaire Météorologique pour 1906. Par A. Lancaster, Observatoire Royal de Belgique. Bruxelles, 1906.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th September 1906:—One-inch Map (third edition, engraved, in outline).—Sheets 36, 40, 46. Price 1s. 6d. each. Third edition, printed in colours and folded in cover, or flat in sheets. Kirkmaiden and Whithorn, Sheets 1 and 2; Stranraer and Kirkmaiden, Sheets 1 and 3, and part of Sheet 7; Wigtown, Sheet 4; Kirkcudbright, Sheet 5; Killean, Sheet 20; Island of Arran, Parts of Sheets 21 and 13; Kilmarnock, Sheet 22 and part of Sheet 21. Price, on paper 1s. 6d.; mounted on linen 2s.; mounted in sections 2s. 6d. each.

Six-inch and larger Scale Maps. Six-inch Maps (revised) full sheets, engraved, without contours. *Sutherland.*—Sheets 61, 73, 77, 91. Price 2s. 6d. each. Sheet 91A, price 2s.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Caithness.*—Sheets V. 5, 6, 8, 11, 15; VI. 10; VII. 6, 14, 15; XI. 8; XII. 2, 9; XIV. 2; XVI. 4, 8; XXII. 3.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY.—The following publications were issued from 1st to 30th September 1906:—Map of the British Islands. Scale 25 miles to 1 inch. Showing the Sheets on the 4-mile and 1-inch Scales, with particulars of Memoirs, Maps, Sections, etc., printed on back. Price 1s.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st October 1906:—One-inch Map (third edition), engraved, in outline. Sheet 60. Price 1s. 6d. Third edition, engraved, with hills in brown or black. Sheets 19, 21, 27, 39, 41, 53. Price 1s. 6d. each.

Six-inch and larger Scale Maps. Six-inch Maps (Revised), full sheets, engraved, without contours. *Sutherland.*—Sheets 43, 52, 53, 64, 74, 75, 76, 86; Price 2s. 6d. each. Sheet (48A and 58A). Price 2s.

1 : 2500 Scale Maps (Revised), with Houses ruled and with Areas. Price 3s. each. *Caithness.*—Sheets VII. 13; XI. 7, 11, 12, 13, 14, 15, 16; XII. 1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16; XIII. 1, 2, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; XIV. 1, 5, 6 (9 and 13); XVI. 12, 16; XVII. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16; XVIII. 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15; XIX. 2, 6, 7, 15, 16; XX. 10, 14; XXII. 4; XXIII. 4, 12; XXIV. 4; XXVIII. 5, 6, 11. Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st October 1906.

Six-inch maps, Quarter Sheets, uncoloured. Price 1s. 6d. each. *Edinburghshire.*—4 NW., 14 NW., 14 NE., 14 SW., 14 SE.

SCOTLAND.—The World-Wide Series of Motoring and Cycling Maps—Aberdeen, Dundee, and Deeside District. Scale 3 miles to an inch. Price 1s. 6d. mounted on cloth. *W. and A. K. Johnston, Ltd., Edinburgh.*

SCOTLAND.—Bartholomew's Reduced Survey Map, Sheet 1. Wigtown and Stranraer District. New Edition, 1906. Price 1s. paper, 2s. mounted on cloth. *John Bartholomew and Co., Edinburgh.*

ENGLAND.—The World-Wide Series of Motoring and Cycling Maps—Shakespeare's Country and the Severn and Wye. Scale 3 miles to an inch. Price 1s. 6d. mounted on cloth. Also General Map of England and Wales. Scale 14 miles to an inch. Price 2s. mounted on cloth.
W. and A. K. Johnston, Ltd., Edinburgh.

LONDON AND NEIGHBOURHOOD.—Bartholomew's Road Surface Map for Motorists and Cyclists, coloured to show roads with wood pavement, asphalt, macadam, granite pavement, etc., in London and neighbourhood. Scale 2 inches to a mile. Price 2s. 6d. mounted on cloth.
John Bartholomew and Co., Edinburgh.

AFRICA.

AFRICA.—General Staff Map on scale of 1 : 1,000,000, or about 16 miles to an inch. District Sheets—72, Kumase; 1906. 84, Nouvelle Anvers; 1906. Price 2s. each sheet. *Topographical Section, General Staff, London.*

UGANDA.—General Staff Map on scale of 1 : 250,000, or about 4 miles to an inch. Sheets 86-C, 86-D, 86-G, 86-H, 86-K, 86-L, 86-O, 86-P. 1905. Price 1s. 6d. each sheet. *Topographical Section, General Staff, London.*

ASIA.

CHINA.—Province of Shan-Tung. Scale 1 : 1,000,000, or about 16 miles to an inch. 1905. Price 2s. 6d.
Topographical Section, General Staff, London.

CHINA.—Map of Yün-Nan, compiled by Major H. R. Davies. Scale 1 : 1,267,200, or 20 miles to an inch. 1906. Price 3s. 6d.
Topographical Section, General Staff, London.

WORLD MAPS AND ATLASES.

BATHYMETRICAL CHART OF THE WORLD.—Carte générale bathymétrique des Océans, dressée par ordre de S.A.S. le Prince de Monaco, d'après le mémoire de M. le Professeur Thoulet, adopté par la Commission de nomenclature sub-océanique et par le Congrès international de Géographie de Washington 1904, sous la direction de M. Charles Sauerwein, par M. Tollemer avec la collaboration de MM. Bataille, Bolzé, Lebas, Lévêque, Morelli, Normand. In 26 sheets. Scale 1 : 10,000,000.
Monaco : Musée Océanographique, 1905.
Presented by the Prince of Monaco.

The science of Oceanography is indebted to the Prince of Monaco for the largest and most complete Bathymetrical Chart of the Oceans yet produced. It is an elaborate piece of work and beautifully executed. It occupies no less than twenty-six large sheets, and is drawn on a scale large enough to permit of marking all ascertained deep-sea soundings, except where they happen to come very close together. Bathymetrical contour lines are drawn at intervals of 200, 500, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000 and 9000 mètres and coloured in graded tints of blue according to depth. The character of the bottom deposits is indicated at intervals. In the naming of the submarine

depressions, ridges, and other features of the floor of the ocean, Professor Thoulet follows the scheme of nomenclature approved by the Washington Congress of Geography in 1904. Comparing the general bathymetrical features with recent British charts, we note many differences of contour, but most of them, owing to paucity of soundings, might possibly be as correct drawn the one way as the other. We are, however, surprised to see a considerable new depression of no less than 6309 mètres mapped between New Zealand and the Chatham Islands. The charts of the British Hydrographic Office are usually very reliable, but they represent this region as a submarine plateau and not a deep. While the chart deserves so much praise, it is not without some defects, and one of the most serious is the omission of the names of islands and shoals except in the case of very large ones, in which cases the name is already familiar. Thus Iceland is named, whilst Jan Mayen, Rockall, and the Faroe Islands are unnamed. In the case of smaller islands in the Pacific the absence of names makes their identification troublesome. It is, however, a compensating and valuable feature that the parallels and meridians are drawn at intervals of every degree.

THE HARMSWORTH ATLAS AND GAZETTEER.—A series of 500 maps and diagrams with Gazetteer of 105,000 references. Complete in 36 parts. Part 1 contains maps of Atlantic Ocean, Europe, East of England, France, and the Near East, also section of Gazetteer Index. Part 2 contains maps of the British Empire, Africa, and Industrial North America, with section of Gazetteer Index. 1906. Price 7d. each part.

The Amalgamated Press, Limited, London.

In this age of strenuous advertising there is a regrettable tendency to distort and disguise facts so that a more or less ignorant public is often entirely misled. Thus, in the prospectuses and advertisements of the *Harmsworth Atlas* the public is assured that it is an "altogether new work, specially designed and prepared at the London Geographical Institute," and that it includes the contents of a series of atlases selling at £15. But the fact is carefully suppressed that most of the maps in this £15 series were engraved in Edinburgh about half a century ago and are therefore very far from being "absolutely new." Part 1 is certainly a marvel of cheapness and contains several recent maps; but in Part 2 there is a great falling-off, as it only contains three maps. The plates are revised to date and clearly printed. The plan of the Index Gazetteer is excellent, but it bears evidence of hurried preparation. Railways in Skye are fortunately still as unknown as snakes in Iceland, but we are informed that "Achnacloich" is a "railway station" in the Isle of Skye. "Abington" is also represented as a "fishing village" in Scotland.

ATLAS OF THE WORLD'S COMMERCE.—A new series of maps with descriptive text and diagrams showing Products, Imports and Exports, Commercial and Economic Statistics of the Countries of the World. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., etc. Complete in 22 parts. Part 10, Commercial Maps and Diagrams relating to Europe and the Near East, also China, Japan, and the Far East. Part 11, Maps and text illustrating Potatoes and Manioc, Maize and Oats, Rice and Rye—Fisheries. Part 12, Maps and text illustrating Rice, Rye, Barley, Millet, Sago, Beer and Spirits, Cocoa and Spices. Part 13, Maps and text illustrating Flax, Hemp, Jute, Precious Stones, Petroleum, Asphalt. 1906. Price 6d. each part.

George Newnes, Limited, London.

M'DOUGALL'S SCHOOL ATLAS.—Containing 22 maps in colour, 16 maps in photo-relief, and 4 diagrams. Price 6d. net.

M'Dougall's Educational Company, Limited, Edinburgh.

SERIES OF AUTOGRAPH HAND-MAPS.—The World, British Isles, England and Wales, Scotland, Ireland, Europe, Asia, Africa, N. America, S. America, Atlas Lands, Australasia, Greece, Italy, France, Spain, Netherlands, Central Europe, Danube Lands, Mediterranean, New Zealand, Ægean, Near East, India, United States, South Africa, British Columbia, Eastern Canada, Eastern Australia, Atlantic Ocean. Price 1d. net each map.

W. Stanford and Co., Ltd., Oxford.

These are clear outline maps, showing hill-shading as well as the coast-line and rivers printed in brown (see also p. 661).

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Twenty-second Session, 1905-1906.

The Council has the honour to submit the following Report :—

Membership.

The changes which occurred during the Session in the number of members were as follows :—

Number on 1st November 1905, ...		1790
New members added, ...		186
		1976
Deduct by Death, ...	39	
„ Resignation, ...	85	
	——	124
Number remaining on Roll on 31st October 1906, . .		1852

Of this number, 1086 are on the Edinburgh list, 368 are on the Glasgow list, 149 and 100 are on the Dundee and Aberdeen lists respectively. In addition to those on the lists named, 48 members reside abroad, and 101 reside in England. Of the total number of 1852 members, 271 are life members.

Twenty-first Anniversary Banquet.

To commemorate the Twenty-first Anniversary of the Society, a Banquet was held on the 27th November 1905 in the North British Station Hotel, Edinburgh. Professor James Geikie, D.C.L., LL.D., F.R.S., President of the Society, presided over an attendance of one hundred gentlemen.

Meetings.

The Society's Anniversary Meeting was addressed by Sir Archibald Geikie, D.C.L., L.L.D., Sec. R.S. Thirty-four ordinary meetings were held, eight of them in Edinburgh, eight in Glasgow, nine in Dundee, and nine in Aberdeen. These meetings were addressed by Sir Charles N. E. Eliot, K.C.M.G., C.B., Miss A. L. A. Murcutt, F.R.S.G.S., Major C. H. D. Ryder, D.S.O., R.E., Mr. R. N. Hall,

F.R.G.S., Dr. Charles Sarolea, D.Ph., D.Litt., Major Ronald Ross, C.B., LL.D., F.R.S., D.Sc., Charles J. Wilson, F.R.S.G.S., Sir Harry H. Johnston, G.C.M.G., K.C.B., Mr. W. S. Bruce, F.R.S.G.S., Viscount Mountmorres, Mr. Walter James, K.C., and Thomas Murdoch, F.G.S.

Medals Awarded.

The Livingstone Gold Medal of the Society for 1905 was presented by Brigadier-General the Right Hon. Lord Playfair, C.V.O., R.A., Vice-President, to Sir Archibald Geikie, D.C.L., LL.D., Sec.R.S., in recognition of his distinguished contributions to geographical science, notably the physical geography of Scotland.

The Society's Silver Medals for 1905 were awarded to Robert C. Mossman, F.R.S.E., for his valuable scientific services as a member of the Scottish National Antarctic Expedition; Major C. H. D. Ryder, D.S.O., R.E., for his explorations in Western Tibet; Major A. St. Hill Gibbons, F.R.G.S., for his explorations in Central and South Africa.

Glasgow Centre.

A new arrangement has been made with the Royal Philosophical Society of Glasgow whereby the members of the Glasgow Centre will have the advantage of that Society's very complete Library at 207 Bath Street, Glasgow, which will be available to them without extra payment. The arrangement commences in November.

Members desirous of exercising this privilege must exhibit their membership cards for the current session to the Librarian at 207 Bath Street, in order that their names may be registered, and they must conform generally to such regulations as may from time to time be laid down by the Royal Philosophical Society.

The room at 207 Bath Street, rented by the Society, has been retained for the exclusive use of Members of the Glasgow Centre.

The Council hopes that this arrangement with the Royal Philosophical Society of Glasgow, so successfully concluded by Mr. A. Crosbie Turner, may result in great benefit to the members of the Glasgow Centre.

Memorial Presented by the Society to the Secretary for Scotland.

On 1st June a largely attended deputation from the Council of the Society waited on the Right Hon. John Sinclair, M.P., Secretary for Scotland, at his office in Edinburgh, and presented to him a memorial (published in the July number of the Society's *Magazine*) setting forth the valuable work done by the Society during the past twenty-one years, and praying for remission of the rent of £125 now paid to Government. The deputation pointed out that similar societies in England and Ireland, instead of paying rent to Government, received considerable annual grants from it, while the Scottish Society had never received any grant. They also directed Mr. Sinclair's attention to the fact that the National Galleries of Scotland Bill introduced by him, while transferring the Society's premises to a new board, neither remitted the Society's rent nor gave the Society any security of tenure. They accordingly begged Mr. Sinclair to amend the Bill in regard to these two points. He replied very courteously, but as yet the prayer of the Society's Memorial has not been granted, although the Scottish members of Parliament have, without distinction of party, expressed themselves in favour of it. The Council would take this opportunity of thanking these members for the warm interest they have shown in the welfare of the Society.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1905 to 31st October 1906.

FUNDS AT THE CLOSE OF LAST ACCOUNT :—			
£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost price, as at 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890,		496 2 0	
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost price, as at 31st December 1898,		312 2 9	
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost price, as at 11th December 1902,		306 8 9	
		£2217 13 3	
BALANCES due by Bank of Scotland—			
1. On Account Current,	£355 11 6		
2. On Deposit Receipt,	4 19 5		
3. Do. do., Equipment Fund (Glasgow)	54 17 10		
		415 8 9	
BALANCE due by Secretary,		32 2 7	
		£2665 4 7	
BALANCE due to Livingstone Fund,		27 11 10	
		£2637 12 9	
SUBSCRIPTIONS from Ordinary Members,	£1529 15 0		
Do. do. Life Members,	10 0 0		
FEES received for Society's Diploma,	31 10 0		
DIVIDENDS and INTEREST,	81 12 9		
		1652 17 9	
		£4290 10 6	

MAGAZINE—Expenses of Publication, etc., from Nos. 10 to 12 of Vol. XXI., and Nos. 1 to 9 of Vol. XXII. :—			
Printing and other charges,			£553 8 11
Illustrations			77 6 2
Maps,			113 13 6
			£744 8 7
Less—			
Magazines sold,	£51 4 11		
Advertising Receipts, less Payments,	165 19 0		
		217 3 11	
			£527 4 8
GENERAL PRINTING,			84 18 8
BOOKS and other furnishings for Library,			19 8 9
RENTS OF HALLS, and other expenses of Lectures,	£552 19 5		
Less Lecture Tickets sold,	121 14 0		
		431 5 5	
GLASGOW BRANCH, Rent of Hall			20 0 0
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,			137 5 9
SALARIES,			517 3 2
MISCELLANEOUS, including Stationery, General Expenses, Postages, and expense of Society's Guests at Banquet, etc.,			156 0 2
MEDALS,			4 16 6
			£1898 2 1
FUNDS AT CLOSE OF THIS ACCOUNT:			
£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost price, as at 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890,		496 2 0	
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost price, as at 31st December 1898,		312 2 9	
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost price, as at 11th December 1902,		306 8 9	
		£2217 13 3	
BALANCE due by the Bank of Scotland :—			
1. On Account Current,	£13 17 5		
2. On Deposit Receipt,	1 19 5		
3. On do. do. (Glasgow Equipment Fund),	55 17 6		
		74 14 4	
BALANCE due by Secretary,		11 18 2	
BALANCE due for Advertisements (since paid)		116 2 10	
		£2420 8 7	
BALANCE due to Livingstone Fund,		28 1 2	
			2392 7 5
			£4290 10 6

Edinburgh, 6th November 1906.—We have examined the Accounts of the Royal Scottish Geographical Society for the year ending 31st October 1906, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

MACANDREW & BLAIR, C.A.

LIVINGSTONE MEDAL FUND.

FUNDS AT CLOSE OF LAST ACCOUNT:—						
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,				£999	11	6
Balance due by General Fund,				27	11	10
				£1027	3	4
Income received—						
Dividend on £770 North British Railway Company 4 per cent. Preference Stock No. 1—						
For half-year to 31st January 1905, £16, 8s., less tax,	£14	12	8			
For half-year to 31st July 1906, £15, 8s., less tax,	11	12	8			
				29	5	4
				£1056	8	8

Paid Messrs. Alex. Kirkwood and Sons for Medal,				£28	16	0
Funds at close of this Account—						
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,			£999	11	6	
Balance due by General Fund,			28	1	2	
				1027	12	8
				£1056	8	8

Edinburgh, 6th November 1906.—Examined and found correct.—MACANDREW & BLAIR, C.A.

Geographical Chair in the University of Edinburgh.

The subscriptions to the Society's Fund for the Founding of a Chair of Geography in the University of Edinburgh amount at the present date to about £2000. Mr. Carnegie has promised to subscribe to the Fund provided it receives proper support in Scotland.

As the provision of adequate geographical teaching in the University is now a matter of urgent necessity, it is hoped that the Society's endeavour to endow the Chair of Geography may receive the liberal support of its members.

The Society's Magazine.

The *Scottish Geographical Magazine* has, as usual, been published throughout the past session monthly, with maps and illustrations.

The Council is glad to acknowledge its obligation to the contributors of articles, and to the following gentlemen who have rendered valuable assistance to the editors :—Hon. John Abercromby ; J. G. Bartholomew ; R. N. Rudmose Brown ; W. S. Bruce ; H. M. Cadell ; Rev. Hugh Callan ; S. H. F. Capenny ; Dr. A. S. Cumming ; James Currie ; Dr. George Dods ; Dr. R. N. Felkin ; H. B. Finlay ; Professor James Geikie ; Rev. James B. Johnston, B.D. ; Rev. Robert Mackenzie ; R. C. Mossman ; H. B. Muff ; J. R. Reid ; Ralph Richardson ; Kenneth Sanderson ; Dr. Charles Sarolea ; Dr. George Smith ; C. W. A. Tait ; W. A. Taylor ; W. B. Wilson.

Library and Map Department.

During the past session 167 books, 38 pamphlets, 106 reports, 8 atlases, 310 map-sheets and charts have been added to the Library. The number of volumes borrowed by members was 1400, and the Library was, as usual, much consulted by non-members in search of geographical information.

The Council desires to record its thanks to foreign and colonial governments for the official publications they have presented to the Library ; to the Treasury, which has approved of the presentation to the Society of the revised Ordnance Survey Maps of Scotland, both in outline and colour, as each of the revisions now in progress is published ; and also to the undermentioned private donors of books and maps, viz. :—Prince of Monaco ; Ralph Richardson ; Rev. Wm. Gunn ; Sir Harry Johnston ; Joseph Partsch, Ph.D. ; J. E. Shearer ; W. J. Watson ; J. A. Harvie-Brown ; C. G. Cash ; James Macdonald.

Coutts Trotter Bequest.

The Council desires specially to acknowledge a legacy of thirty volumes on Geography and Anthropology bequeathed to the Society by the late Mr. Coutts Trotter ; and further to thank Colonel P. Durham Trotter for an additional work, since presented on behalf of his brother.

Glasgow, Dundee, and Aberdeen Centres.

The Council has again the pleasure to acknowledge the services rendered by the honorary officials of the Glasgow, Dundee, and Aberdeen Centres for their continued successful conduct of the business of the Society.

Finance.

The Council begs to submit the Annual Financial Statement.

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The Scottish geographical magazine

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